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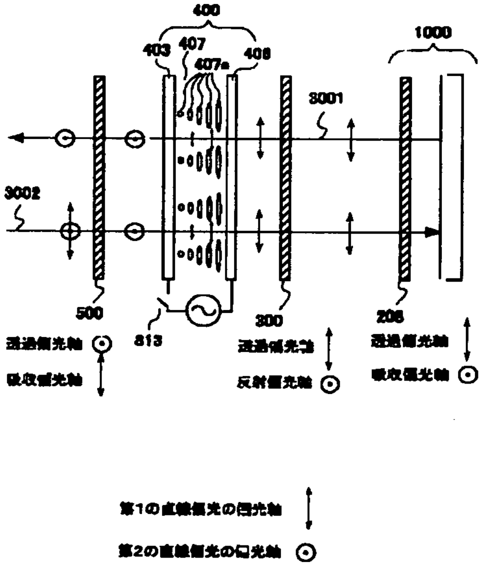
(54)【発明の名称】 画像表示状態と鏡状態とを切り替え可能な装置、および、これを備えた機器

(57)【要約】

【課題】高画質な画像を表示する状態と、人が自分の顔や姿を映して観察するのに適した見やすい反射像が得られる鏡状態とに切り替え可能な装置を提供する。

【解決手段】画像光３００１を出射する画像表示部１０００と、画像表示部１０００から出射される第１の直線偏光成分は透過し、これと偏光軸が直交する第２の直線偏光成分は反射する反射型偏光選択手段３００と、入射した直線偏光光の偏光軸を変化させる状態および変化させない状態のいずれかを選択可能な透過偏光軸可変部４００と、入射した光のうち第１の直線偏光成分は吸収し、これと偏光軸が直交する第２の直線偏光成分は透過する偏光選択部材５００とをこの順に配置した。このとき画像表示部１０００には、吸収型偏光選択手段２０８を配置し、画像光として第１の直線偏光を出射させる。

図１



Best Available Copy

【特許請求の範囲】

【請求項１】所望の画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、前記画像光を透過する画像透過状態と外光を反射する鏡状態とに切り替え可能な鏡機能部とを有し、

該鏡機能部は、前記画像表示部側から順に配置された、反射型偏光選択手段と、透過偏光軸可変手段と、吸収型偏光選択手段とを含み、前記反射型偏光選択手段は、予め定めた偏光軸の第１の偏光を透過し、前記第１の偏光と偏光軸が交差する第２の偏光を反射し、前記透過偏光軸可変手段は、入射した前記第１の偏光を前記第２の偏光へ変化させて透過する状態と、入射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記吸収型偏光選択手段は、前記第１の偏光および前記第２の偏光のうち一方を透過し、他方を吸収し、

前記画像表示部は、前記第１の偏光を透過し、前記第２の偏光を吸収する画像光用偏光選択手段を備え、前記画像光用偏光選択手段を透過した前記第１の偏光を前記画像光として出射することを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項２】請求項１に記載の装置において、前記鏡機能部を前記画像透過状態と前記鏡状態とで切り替えるための切り替え手段を有し、該切り替え手段は、前記透過偏光軸可変手段を前記第１の偏光を前記第２の偏光へ変化させる状態に切り替えることにより、前記鏡機能部を前記画像透過状態に切り替え、前記透過偏光軸可変手段を前記入射した偏光軸を変化させないで透過する状態に切り替えることにより、前記鏡機能部を前記鏡状態に切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項３】請求項１に記載の装置において、前記鏡機能部を前記画像透過状態と前記鏡状態とで切り替えるための切り替え手段を有し、該切り替え手段は、前記透過偏光軸可変手段を前記入射した偏光軸を変化させないで透過する状態に切り替えることにより、前記鏡機能部を前記画像透過状態に切り替え、前記透過偏光軸可変手段を前記第１の偏光を前記第２の偏光へ変化させる状態に切り替えることにより、前記鏡機能部を前記鏡状態に切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項４】所望の画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、前記画像光を透過する画像透過状態と外光を反射する鏡状態とに切り替え可能な鏡機能部とを有し、

該鏡機能部は、前記画像表示部側から順に配置された、第１の反射型偏光選択手段と、透過偏光軸可変手段と、第２の反射型偏光選択手段と、可変偏光選択手段とを含み、前記第１の反射型偏光選択手段は、予め定めた偏光軸の第１の偏光を透過し、前記第１の偏光と偏光軸が交差する第２の偏光を反射し、前記透過偏光軸可変手段は、入射した前記第１の偏光を前記第２の偏光へ変化させて透過する状態と、入射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記第２の反射型偏光選択手段は、前記第１の偏光および前記第２の偏光のうち一方を反射し、他方を透過し、前記可変偏光選択手段は、前記第１の偏光および第２の偏光のうち一方を吸収し、他方を透過する状態と、全偏光成分を透過する状態とに切り替え可能であり、

前記画像表示部は、前記第１の偏光を透過し、前記第２の偏光を吸収する画像光用偏光選択手段を備え、前記画像光用偏光選択手段を透過した前記第１の偏光を前記画像光として出射することを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項５】請求項４に記載の装置において、前記鏡機能部を前記画像透過状態と前記鏡状態とで切り替えるための切り替え手段を有し、該切り替え手段は、前記透過偏光軸可変手段を、前記第１の偏光を前記第２の偏光へ変化させる状態に切り替えるとともに、前記可変偏光選択手段を、前記第１の偏光を吸収し前記第２の偏光を透過する状態に切り替えることにより、前記鏡機能部を前記画像透過状態に切り替え、前記透過偏光軸可変手段を、前記入射した偏光軸を変化させないで透過する状態に切り替えるとともに、前記可変偏光選択手段を、前記全偏光成分を透過する状態に切り替えることにより、前記鏡機能部を前記鏡状態に切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項６】請求項４に記載の装置において、前記鏡機能部を前記画像透過状態と前記鏡状態とで切り替えるための切り替え手段を有し、該切り替え手段は、前記透過偏光軸可変手段を、前記入射した偏光軸を変化させないで透過する状態に切り替えるとともに、前記可変偏光選択手段を、前記第２の偏光を吸収し前記第１の偏光を透過する状態に切り替えることにより、前記鏡機能部を前記画像透過状態に切り替え、前記透過偏光軸可変手段を、前記第１の偏光を前記第２の偏光へ変化させる状態に切り替えるとともに、前記可変偏光選択手段を、前記全偏光成分を透過する状態に切り替えることにより、前記鏡機能部を前記鏡状態に切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項７】所望の画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、前記画像光を透過する画像透過状態と外光を反射する鏡状態とに切り替え可能な鏡機能部とを有し、

該鏡機能部は、前記画像表示部側から順に配置された、第１の反射型偏光選択手段と、透過偏光軸可変手段と、第２の反射型偏光選択手段とを含み、前記第１の反射型偏光選択手段は、予め定めた偏光軸の第１の偏光を透過し、前記第１の偏光と偏光軸が交差する第２の偏光を反射し、前記透過偏光軸可変手段は、入射した前記第１の偏光を前記第２の偏光へ変化させて透過する状態と、入

射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記第２の反射型偏光選択手段は、前記第１の偏光および前記第２の偏光のうち一方を反射し、他方を透過し、

前記画像表示部は、前記第１の偏光を透過し、前記第２の偏光を吸収する画像光用偏光選択手段を備え、前記画像光用偏光選択手段を透過した前記第１の偏光を前記画像光として出射することを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項８】請求項２、３，５または６に記載の装置において、前記画像表示部は前記画像光を出射しない状態に切り替え可能であり、前記切り替え手段は、前記鏡機能部を前記鏡状態に切り替えた場合には、これと連動させて、前記画像光を出射させない状態に前記画像表示部を切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項９】請求項８に記載の装置において、前記画像表示部は、照明装置と、液晶素子とを含み、前記切り替え手段は、前記画像光を出射させない状態に前記画像表示部を切り替えるために、前記照明装置を消灯するか、もしくは、前記液晶素子を暗表示に切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１０】請求項８に記載の装置において、前記透過偏光軸可変手段は、一部の領域のみを前記入射した偏光軸を変化させないで透過する状態に切り替え可能な構成であり、

前記切り替え手段は、前記一部の領域のみを、前記入射した偏光軸を変化させないで透過する状態に切り替えた場合には、前記一部の領域と重なり合う部分の前記画像表示部の表示を暗表示に切り替えて、当該部分から前記画像光を出射させないことを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１１】請求項１、４または７に記載の装置おいて、前記透過偏光軸可変手段は、液晶層と、該液晶層の層厚方向に電界を印加するための電極とを含み、該液晶層は、電界が印加されていないときに液晶分子の長軸方向が層厚方向に連続的に９０度捻れ、電界が印加されているときに液晶分子の長軸方向が層厚方向に平行になる構成であり、前記鏡機能部が鏡状態のとき、前記透過偏光軸可変手段は前記液晶層に電界を印加している状態であることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１２】請求項１、４または７に記載の装置おいて、前記透過偏光軸可変手段は、液晶層と、該液晶層の層厚方向に電界を印加するための電極とを含み、該液晶層は、電界が印加されていないときに液晶分子の長軸方向が層厚方向に連続的に９０度捻れ、電界が印加されているときに液晶分子の長軸方向が層厚方向に平行になる構成であり、前記鏡機能部が鏡状態のとき、前記透過偏光軸可変手段は前記液晶層に電界を印加していない状態であることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１３】請求項１に記載の装置において、前記画像光用偏光選択手段の偏光度をＰ１、前記吸収型偏光選択手段の偏光度をＰ２とした場合、０．９６６≦Ｐ１≦０．９９５≦Ｐ２の関係を満たすことを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１４】請求項１に記載の装置において、前記画像光用偏光選択手段の偏光度をＰ１、前記吸収型偏光選択手段の偏光度をＰ２とした場合、０．９６６≦Ｐ２≦０．９９５≦Ｐ１の関係を満たし、前記鏡機能部を前記鏡状態に切り替えた場合には、これと連動させて、前記画像光を出射させない状態に前記画像表示部を切り替えることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１５】請求項４または７に記載の装置において、前記第１の反射型偏光選択手段は、前記第２の反射型偏光選択手段との間隔が０．１１mm以下となるように配置されていることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１６】請求項１、４または７に記載の装置において、前記鏡機能部は、鏡状態となる領域の大きさが少なくとも５８．６mm×３９．１mmであることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１７】請求項１に記載の装置において、前記画像表示部は、有機エレクトロルミネッセンス表示素子を含み、有機エレクトロルミネッセンス表示素子の発光層と前記反射型偏光選択手段との間には、位相差板と前記画像光用偏光選択手段とが配置されていることを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【請求項１８】第１の偏光状態を有する光を出射する画像表示部と、前記画像表示部に重畳して配置され、前記画像表示部材からの画像光を透過する画像表示状態と、外部から前記画像表示部材へ向かう光を反射する鏡状態とのうちいずれかを選択可能な鏡機能部とを備え、

前記鏡機能部が鏡状態に切り替えられた場合、その動作に連動して、前記画像表示部材の発光状態を非発光状態に切替える切り替え手段を設けたことを特徴とする表示装置。

【請求項１９】請求項１８に記載の表示装置において、

前記画像表示部が、一定の間隙をもって接合された一対の透明基板と、これら透明基板間に挟持された液晶層と、前記一対の透明基板の少なくとも一方に透明電極により形成されるマトリクス状に配置された画素電極群と、該液晶層の視認側に配置した前記第１の直線偏光成分は透過して前記第２の直線偏光成分は吸収する表示用偏光選択手段と、該液晶層の裏面側に配置した偏光板と、さらにその背面に配置した照明装置とを有し、

前記切り替え手段は、前記鏡機能部が鏡状態の場合に前

記照明装置を消灯することを特徴とする表示装置。

【請求項２０】請求項１８に記載の表示装置において、前記画像表示部が、一定の間隙をもって接合された一対の透明基板と、これら透明基板間に挟持された液晶層と、前記一対の透明基板の少なくとも一方に透明電極により形成されるマトリクス状に配置された画素電極群と、該液晶層の視認側に配置した前記第１の直線偏光成分は透過して前記第２の直線偏光成分は吸収する表示用偏光選択手段と、該液晶層の裏面側に配置した偏光板と、さらにその背面に配置した照明装置とを有し、

前記切り替え手段は、前記鏡機能部が鏡状態の場合に該鏡状態の領域と重なる前記画像表示部材の領域の前記液晶層を暗表示状態にすることを特徴とする表示装置。

【請求項２１】表示装置を備える機器であって、

該表示装置は、所望の画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、前記画像光を透過する画像透過状態と外光を反射する鏡状態とに切り替え可能な鏡機能部とを有し、

該鏡機能部は、前記画像表示部側から順に配置された、反射型偏光選択手段と、透過偏光軸可変手段と、吸収型偏光選択手段とを含み、前記反射型偏光選択手段は、予め定めた偏光軸の第１の偏光を透過し、前記第１の偏光と偏光軸が交差する第２の偏光を反射し、前記透過偏光軸可変手段は、入射した前記第１の偏光を前記第２の偏光へ変化させて透過する状態と、入射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記吸収型偏光選択手段は、前記第１の偏光を透過し、前記第２の偏光を吸収し、

前記画像表示部は、前記第１の偏光を透過し、前記第２の偏光を吸収する画像光用偏光選択手段を備え、前記画像光用偏光選択手段を透過した前記第１の偏光を前記画像光として出射することを特徴とする機器。

【請求項２２】所望のカラー画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、切り替え機能部とを有し、

前記切り替え機能部は、前記画像表示部の前記画像光を外部に透過させて外部にカラー画像を表示させる状態と、前記画像表示部を鏡状態にするために、入射した外光を前記画像表示部に反射される偏光状態に変化させる状態とに切り替え可能であり、

該切り替え機能部は、前記画像表示部側から順に配置された、透過偏光軸可変手段と、吸収型偏光選択手段とを含み、前記透過偏光軸可変手段は、予め定めた偏光軸の第１の偏光が入射すると前記第１の偏光と偏光軸が交差する第２の偏光へ変化させて透過する状態と、入射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記吸収型偏光選択手段は、前記第１の偏光および前記第２の偏光のうち一方を透過し、他方を吸収し、

前記画像表示部は、フィールド順次カラー表示方式によりカラー表示を行う構成であり、

前記画像表示部は、前記第１の偏光を透過し、前記第２の偏光を反射する反射型偏光選択手段を備え、該反射型偏光選択手段を透過させることにより、前記第１の偏光のカラーの前記画像光を生成することを特徴とする画像表示状態と鏡状態とを切り替え可能な装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、表示画面を鏡に切り替えることができる鏡機能付き表示装置およびこれを備えた機器、または、鏡を画像表示画面に切り替えることができる画像表示機能付き鏡およびこれを備えた機器に関する。

【０００２】

【従来の技術】外光を反射する鏡状態に切り替え可能な表示装置（或いは表示機能を備えた鏡）としては、例えば特開平１１−１５３９２号公報や特開平１１−２９１８１７号公報等に記載されているように、液晶表示装置等の画像表示部材の前面にハーフミラー素材を配置した表示装置が知られている。これらの表示装置では、照明装置が消灯時、或いは画像が暗表示の場合には、ハーフミラー素材で反射される外光がハーフミラー素材を透過する画像光より多くなるため、鏡状態となる。一方、照明装置が点灯時、或いは画像が明表示の場合には、ハーフミラー素材を透過する画像光はハーフミラー素材で反射する外光より多くなるため、画像表示状態となる。即ち、これらの表示装置では、ハーフミラー素材背面の画像表示部材の明るさを切り替えることで、同一観察面を鏡状態と画像表示状態とに切り替え可能にしたものである。

【０００３】また、国際公開番号ＷＯ９９／０４３１５の再公表公報には、画像表示が観察されるシャッタ開状態と画像表示が観察されないシャッタ閉状態とに切り替え可能な液晶表示装置が開示されている。この公報によれば、シャッタ閉状態の際には、外光が反射され”メタル調”になると記載されている。

【０００４】このＷＯ９９／０４３１５の再公表公報の液晶表示装置は、電極を備えた一対の基板の間隙に液晶層を封入した液晶表示パネルを２枚積み重ね、この積み重ねた２枚の液晶表示パネルの上面と、下面と、２枚の液晶表示パネルの間の３カ所に偏光板を配置したものである。これらの偏光板のうち、液晶表示パネルの間に配置する偏光板として、所定の直線偏光は透過し、これと偏光軸が直交する直線偏光は反射する反射型偏光板を用いている。反射型偏光板の透過偏光軸は、積み重ねた２枚の液晶表示パネルの上面の偏光板の透過偏光軸と平行にしている。また、上側（観察者側）の液晶表示パネルとしては、液晶としてツイストネマティック型液晶を用いている。このような構成では、上側の液晶表示パネルの液晶層に印加する電圧が小さい場合には、上面の偏光

板を透過した光は、液晶層を透過する際に偏光方向が９０度回転して反射型偏光板に至るため、反射型偏光板の反射特性により強く反射される。これにより、”メタル調”のシャッタ閉状態となる。一方、上側の液晶表示パネルの液晶層に印加する電圧が大きい場合には、上面の偏光板と上側の液晶表示パネルと反射型偏光板とが実効的に透明な状態となり、下側の液晶表示パネルの画像表示が観察されるシャッタ開状態となる。すなわち、上側の液晶表示パネルへの印過電圧により、外光が反射され”メタル調”を呈するシャッタ閉状態と、下側の液晶表示パネルの表示が観察されるシャッタ開状態とを切り替えることができる。

【０００５】

【発明が解決しようとする課題】上記従来の表示装置は、外光を反射する鏡のような状態に切り替え可能であるが、この鏡のような状態は、人が自分の顔や姿を映して観察する鏡として使用するには不十分である。これを具体的に以下説明する。

【０００６】上記特開平１１－１５３９２号公報や特開平１１－２９１８１７号公報の表示装置は、ハーフミラーを用いているため、外光を反射する鏡状態の明るさは、ハーフミラーの反射率に依存する。このため、人が自分の顔や姿を映し出す鏡として使用できる明るい鏡にするには、ハーフミラーの反射率を高める必要がある。しかしながら、ハーフミラーの反射率を高めると、画像表示状態の際にハーフミラー素材で反射される光の分だけ画像の光量が低下するため、表示画像が暗くなる。すなわち、画像表示状態での画像の明るさと、鏡状態での鏡の明るさはトレードオフの関係にあるため、明るい画像表示と明るい鏡の両立が困難である。このため、ハーフミラーを用いる表示装置の鏡状態の明るさを、人が自分の顔や姿を映して観察する鏡として使用できるほどまで高めることは難しい。

【０００７】また、このようなハーフミラーを用いる表示装置では、明るい環境下で用いると、画像表示状態であっても、外光の一部がハーフミラーで反射する。このため画像表示状態において外光の映り込みや、外光の反射による画像のコントラスト比の低下といった画質の劣化を生じる。

【０００８】また、上述の国際公開番号ＷＯ９９／０４３１５の再公表公報の表示装置では外光の反射機能を、人が自分の顔や姿を映して観察する鏡として機能させようとした場合に以下の問題を生じる。

【０００９】この表示装置では、２枚の液晶パネルのうち上側（観察者側）の液晶パネルの液晶層に印加する電圧が小さい場合に”メタル調”のシャッタ閉状態となる。このとき、外部から入射した光は、上面の偏光板を透過し、上側の液晶パネルの液晶層を透過し、反射型偏光板で反射されて再び外部へ戻る。これにより、鏡のような反射を呈する。一方、下側の液晶パネルから出射された画像表示光のうち、暗表示部光として偏光の状態を制御された光は、上記反射型偏光板の透過偏光軸と偏光軸が直交しているため、この反射型偏光板により反射され、外部へは出射されない。しかしながら、現実には、透過偏光軸と直交する方向の反射率が１００％という完全な反射型偏光板は存在しないため、一部の暗表示部光は反射型偏光板を透過する。反射型偏光板を透過した暗表示光は、上側の液晶パネルの液晶層を通過することにより偏光軸が上面の偏光板の透過偏光軸と一致するため、これを透過して観察者に視認される。すなわち、シャッタ閉の鏡状態の際に、画像の暗表示部から外部に光漏れが生じる。

【００１０】また、下側の液晶パネルから出射される画像表示光のうち、明表示光として偏光状態を制御された光は、偏光軸が上記反射型偏光板の透過偏光軸と平行であるため、これを透過し、上側の液晶パネルの液晶層を通過する。その際に偏光軸が９０度回転するため、偏光軸が上面の偏光板と直交し、上面の偏光板で吸収される。一般的に知られているように、液晶分子が層厚方向に連続的にツイストしたの液晶層に光を通過させて出射させる場合、層厚方向への液晶分子の傾斜やツイストの状態により、液晶層の斜め方向へ出射される光の偏光状態が異なるため、斜め方向へ出射される光には上面の偏光板の透過偏光軸と平行な偏光成分が含まれる。このため、表示装置の正面方向よりも斜め方向から、多くの光漏れが生じて、観察者に視認されることになる。

【００１１】発明者らが、国際公開番号ＷＯ９９／０４３１５の再公表公報の表示装置とほぼ同様の表示装置を実際に作成して、シャッタ閉状態における光の漏れを測定した結果を、図４４に示す。図４４のグラフは、表示装置をシャッタ開状態で画像表示した場合に明表示部で輝度４５０cd/m$^2$が得られるように下側の液晶パネルで画像表示をさせ、その状態で、上側の液晶パネルをシャッタ閉状態として、表示装置の前面からの光漏れを測定したデータである。図４４の横軸は、表示装置の表示部上の位置を示し、縦軸が、正面方向での輝度値を示す。

【００１２】図４４のように、暗表示部の正面方向の光漏れは、輝度値24～28cd/m$^2$であり、明表示部の正面方向の光漏れは、輝度値４～５cd/m$^2$であった。よって、正面方向の光漏れは、暗表示部の方が明表示部よりも約７倍大きかった。また、暗表示部での光の漏れは位置に対して不均一であり、色むらも認められた。なお、輝度値４～５cd/m$^2$という値は、薄暗い環境下であれば十分に視認できる値である。また、斜め方向から観察した場合は、方向によっては明表示部から４～５cd/m$^2$以上の光の漏れが観察された。このように、従来の表示装置のシャッタ閉状態を鏡として機能させようとすると、光の漏れのために反射像のコントラスト比が著しく低減する。このため、人の顔や姿を映し出す鏡としては、十分ではない。

【0013】なお、反射型偏光板として、例えば国際出願の国際公開番号：WO95／27919号に開示されている異なる複屈折性高分子フィルムを交互に複数層積層した複屈折反射型偏光フィルムを用いることができる。このような反射型偏光板は、通常、液晶素子の裏面側に配置する偏光板と照明装置（バックライト）との間に配置して、照明光の利用効率を向上する目的に使用する場合に極めて高い効果が得られるものである。しかしながら、本発明が目的とするような鏡性能を実現する場合には所定の偏光に対する光の漏れが大きな問題となるためこのような反射型偏光板だけでは十分な鏡性能を得ることができない。

【0014】本発明は、高画質な画像を表示する状態と、人が自分の顔や姿を映して観察するのに適した見やすい反射像が得られる鏡状態とに切り替え可能な装置を提供することを目的とする。

【0015】

【課題を解決するための手段】上記目的を達成するために、本発明によれば、以下のような構成の、画像表示状態と鏡状態とを切り替え可能な装置が提供される。

【0016】すなわち、所望の画像を表示するための画像光を出射する画像表示部と、前記画像表示部に重畳して配置された、前記画像光を透過する画像透過状態と外光を反射する鏡状態とに切り替え可能な鏡機能部とを有し、該鏡機能部は、前記画像表示部側から順に配置された、反射型偏光選択手段と、透過偏光軸可変手段と、吸収型偏光選択手段とを含み、前記反射型偏光選択手段は、予め定めた偏光軸の第1の偏光を透過し、前記第1の偏光と偏光軸が交差する第2の偏光を反射し、前記透過偏光軸可変手段は、入射した前記第1の偏光を前記第2の偏光へ変化させて透過する状態と、入射した光の偏光軸を変化させないで透過する状態とに切り替え可能であり、前記吸収型偏光選択手段は、前記第1の偏光および第2の偏光のうち一方を透過し、他方を吸収し、前記画像表示部は、前記第1の偏光を透過し、前記第2の偏光を吸収する画像光用偏光選択手段を備え、前記画像光用偏光選択手段を透過した前記第1の偏光を前記画像光として出射することを特徴とする画像表示状態と鏡状態とを切り替え可能な装置である。

【0017】

【発明の実施の形態】本実施の形態では、画像表示状態と鏡状態とが切り替え可能な装置（すなわち鏡機能付き表示装置、或いは表示機能付き鏡）を提供する。この装置は、鏡状態では、画像表示光の光漏れを防止して、明るく、コントラスト比の高い反射像を得ることができる。よって、本実施の形態の装置は、鏡状態の場合には、人が自分の顔や姿を映し出し、観察するのに適している。一般的に、人の顔の見え方は、部位の大きさ、輝度値、コントラスト比（輝度対比）等の物理量に依存すると考えられており、コントラスト比（輝度対比）が大きいほど見え易さの評価が高いことが評価実験により確認されている（奥田紫乃、佐藤隆二：人の顔の見え方に対する評価法の構築に関する基礎検討、照明学会誌、第84巻、第11号、pp809-814）。また、本実施の形態の装置は、画像表示状態では、明るい環境下であっても外光の映り込みやコントラスト比の低下といった画質の劣化が少なく、明るい画像が得られる。

【0018】以下、本発明の実施の形態の鏡状態への切り替え機能付き表示装置を図1～図6を参照して説明する。

【0019】まず、第1の実施の形態の鏡状態への切り替え機能付き表示装置の基本構成と動作を図1及び図2を用いて説明する。

【0020】第1の実施の態様の表示装置は、図1のように、順に配置された、画像表示部1000と、反射型偏光選択部材300と、透過偏光軸可変部400と、吸収型偏光選択部材500とを有している。画像表示部1000は、予め定めた方向の直線偏光成分を透過し、それと直交する方向の直線偏光成分を吸収する吸収型偏光選択部材208を含み、この吸収型偏光選択部材208は、反射型偏光選択部材300側に配置されている。本実施の形態では、画像表示部1000は、照明装置と、液晶層と、液晶層を挟む2枚の吸収型偏光選択部材とを含む。2枚の吸収型偏光選択部材のうち出射側ものが、吸収型偏光選択部材208である。液晶層に印加する電圧を明表示領域と暗表示領域とで変化させて、明表示領域からは吸収型偏光選択部材208を透過する直線偏光を出射させ、暗表示領域では吸収型偏光選択部材208で光を吸収させて、光を出射させない。これにより、画像を表示する構成である。よって、画像表示部1000から出射される画像光（明表示光）は、吸収型偏光選択部材208の透過偏光軸と一致した偏光軸を有する直線偏光である。以下、画像光の偏光軸と同じ方向の偏光軸を有する直線偏光を「第1の直線偏光」と称する。また、第1の直線偏光と偏光軸が直交する方向の直線偏光を「第2の直線偏光」と称する。

【0021】反射型偏光選択部材300は、予め定めた方向の直線偏光成分を透過し、それと直交する直線偏光成分を反射する部材である。ここでは、反射型偏光選択部材300は、第1の直線偏光成分は透過し、第2の直線偏光成分は反射する向きに配置している。

【0022】透過偏光軸可変部400は、入射した直線偏光光が透過する際にその偏光軸を変化させる状態と、偏光軸を変化させない状態とを、電気的な切り替えにより選択できる構造を有する素子である。本実施の形態では、透過偏光軸可変部400として、液晶層407と、液晶層407に電圧を印加するための透明電極403、406とを含む液晶素子を用いている。透明電極403には、電圧のオンオフを切り替える切り替えスイッチ813が接続されている。切り替えスイッチ813によ

り、液晶層４０７に印加する電圧をオフにしているときには、液晶層４０７は、入射した直線偏光の偏光軸を変化させる状態であり、電圧をオンにすると偏光軸を変化させない状態となる。本実施の形態では、液晶層４０７は、液晶分子４０７ａの長軸が、電圧オフのときに、透明電極４０３と透明電極４０６との間で連続的に９０°捩じれるように構成した、いわゆるツイストネマティック（ＴＮ）型液晶である。液晶層４０７の配向方向は、反射型偏光選択部材３００側から入射した第１の直線偏光を第２の直線偏光へ変化させる方向に定めている。一方、電圧オンの場合、液晶層４０７の液晶分子４０７ａは、図２のように透明電極４０３、４０６に対して垂直に立った状態となり、入射した光の偏光軸を変化させない状態となる。

【００２３】吸収型偏光選択部材５００は、予め定めた方向の直線偏光成分を透過し、それと直交する方向の直線偏光成分を吸収する部材である。ここでは、吸収型偏光選択部材５００は、入射した光のうち第１の直線偏光成分は吸収して、第２の直線偏光成分は透過するように配置されている。

【００２４】尚、観察者は、吸収型偏光選択部材５００側（図１中の紙面左側）から本表示装置を観察することになる。

【００２５】つぎに、第１の実施の形態の表示装置の動作を図１および図２を用いて説明する。

【００２６】本実施の形態の表示装置を画像表示状態で使用する場合には、図１のように、切り替えスイッチ８１３をオフにして、透過偏光軸可変部４００の液晶層４０７の液晶分子４０７ａが９０°捻れた状態に設定する。この状態で、画像表示部１０００から所望の表示の画像光（明表示光）３００１を出射させる。画像光３００１は、画像表示部１０００の吸収型偏光選択部材２０８を通過している光であるため、第１の直線偏光である。よって、画像光３００１の偏光軸は、反射型偏光選択部材３００の透過偏光軸と一致しており、反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。上述のように、透過偏光軸可変部４００の液晶層４０７はオフ状態に設定されているため、入射した第１の直線偏光の画像光３００１は、液晶分子４０７ａの捻れに沿ってその偏光軸が回転して第２の直線偏光となって出射される。第２の直線偏光となった画像光３００１は、偏光軸が吸収型偏光選択部材５００の透過偏光軸と一致しているため、これを透過して、観察者に観察される。

【００２７】一方、画像表示状態のときに観察者側から表示装置へ入射する外光３００２は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。吸収型偏光選択部材５００を透過した第２の直線偏光の外光３００２は、透過偏光軸可変部４００を透過する際に、第２の直線偏光から第１の直線偏光に変化する。これにより、偏光軸が反射型偏光選択部材３００の透過偏光軸と一致するため、反射型偏光選択部材で反射されることなく透過して画像表示部１０００に入射する。入射した第１の直線偏光の外光３００２は、偏光軸が吸収型偏光選択部材２０８の透過偏光軸と一致しているため、吸収型偏光選択部材２０８を透過し、画像表示部１０００の液晶層に入射する。このとき、暗表示領域に入射した光は、液晶層よりも照明装置側に配置されている吸収型偏光選択部材によって吸収される。よって、観察者側には戻ってこない。また、明表示領域に入射した光は、光源側の吸収型偏光選択部材も透過して照明装置に至る。照明装置に至った光の一部は、これにより反射されるが、反射された光は照明光と実質的に変わりなく、照明光の一部となるため、画質を劣化させる外光の反射とはならない。すなわち、本実施の形態の表示装置では、画像表示状態のときに、外光が入射しても、画質を劣化させる外光の反射はほとんどない。

【００２８】このように、本実施の形態の表示装置は、画像表示状態では、画像光３００１がほとんど損失することなく観察者へ向かうため明るい画像が得られる。一方、外光３００２は表示装置ではほとんど反射されないので、映り込みやコントラスト比の低下等の外光の反射による画質の劣化がほとんどない。

【００２９】つぎに、本実施の形態の表示装置を鏡状態に切り替えて使用する場合について説明する。この場合、図２のように、切り替えスイッチ８１３をオンにして、透過偏光軸可変部４００の液晶層４０７の液晶分子４０７ａを立たせた状態に設定する。

【００３０】このとき、観察者側から本表示装置へ向かう外光３００２は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過し、透過偏光軸可変部４００に入射する。透過偏光軸可変部４００は、液晶層４０７の液晶分子４０７ａが立った状態であるため、入射した外光３００２は偏光状態が変化することなく第２の直線偏光のまま透過偏光軸可変部４００を透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００の反射偏光軸は、第２の直線偏光の偏光軸と一致しているため、外光３００２は反射型偏光選択部材３００によって反射される。反射型偏光選択部材３００で反射した外光３００２は、再び透過偏光軸可変部４００に入射し、第２の直線偏光のままこれを透過して出射され、さらに吸収型偏光選択部材４００も透過して観察者へ向かう。これにより、外光３００２の反射像が得られ鏡状態が実現する。

【００３１】この鏡状態のときに、画像表示部１０００から出射される画像光（明表示光）３００１は、吸収型偏光選択部材２０８を透過した第１の直線偏光であるため、反射型偏光選択部材３００を透過して透過偏光軸可

変部４００に入射する。透過偏光軸可変部４００はオン状態であるため、画像光３００１の偏光状態は変化することなく第１の直線偏光のままこれを透過し、吸収型偏光選択部材５００に入射する。第１の直線偏光は、吸収型偏光選択部材５００の吸収偏光軸に一致しているため、吸収型偏光選択部材５００で吸収されて観察者には観察されない。

【００３２】つまり、鏡状態の場合には画像表示部材からの光は観察者に至ることがなく、一方、周囲から表示装置に入射する外光３００２は理想的には非偏光の半分の光が反射型偏光選択部材３００で反射して、観察者側に向かうため明るい鏡として機能する。

【００３３】なお、鏡状態の場合、本実施の形態の表示装置は、国際公開番号ＷＯ９９／０４３１５の再公表公報の表示装置と比較して、光漏れを大幅に減少させることができる。国際公開番号ＷＯ９９／０４３１５では、鏡状態において反射型偏光板の反射性能に起因する暗表示部からの光漏れが問題であったが、本実施の形態の表示装置では、画像表示部１０００が吸収型偏光選択部材２０８を備え、暗表示領域の照明光を吸収しているため、暗表示領域では反射型偏光選択部材３００に光が到達しない。このため、反射型偏光選択部材３００の性能の如何に関わらず、暗表示領域からの光漏れはほとんど観察されない。

【００３４】また、本実施の形態の表示装置は、鏡状態のときに、透過偏光軸可変部４００をオンにして、液晶分子４０７ａを立たせる構成である。一般にネマティック型液晶は、電圧オンの液晶分子を立たせた状態の方が、電圧オフの液晶分子が捻れた状態のときよりも、斜め方向に出射させる光の偏光軸のずれは小さい。このため、本実施の形態の表示装置は、従来の技術で述べた鏡状態で電圧オフにする構成のものと比較して、鏡状態のときに画像光（明表示光）３００１の斜め方向への光漏れが少ないという効果も得られる。

【００３５】鏡状態における画像表示部１０００からの光の漏れを図３及び図４のグラフを用いて具体的に説明する。図３が明表示領域、図４が暗表示領域での光の漏れの大小を輝度値で表している。これらのグラフは、表示装置が画像表示状態の場合に輝度４５０cd/m$^2$の明表示を行う場合のデータであり、横軸が表示装置の表示部上の位置を示し、縦軸が正面方向、すなわち画面に対して垂直方向での輝度値を示す。また、図３，図４には、画像表示部１０００の吸収型偏光選択部材２０８としてＡタイプ偏光板、Ｂタイプ偏光板、Ｃタイプ偏光板を用いた構成のそれぞれの光漏れと、画像表示部１０００から吸収型偏光選択部材２０８を取り去って、他の構成は本実施の形態の表示装置と同様にした装置の光漏れとを示した。なお、吸収型偏光選択部材２０８を取り去った構成であっても、画像表示状態では通常レベルの画像が表示できた。また、Ａ，Ｂ，Ｃタイプ偏光板の詳細は後述する。

【００３６】図３に示すとおり、鏡状態における明表示領域では、吸収型偏光選択部材２０８を用いる本実施の形態の表示装置の方が、吸収型偏光選択部材２０８がない装置よりも、光の漏れが半分程度に抑えられる。このため、本実施の形態の表示装置は、コントラスト比が高い反射像を映し出す鏡が実現できる。また、鏡状態における暗表示領域部では、図４に示すとおり、吸収型偏光選択部材２０８を用いる本実施の形態の表示装置は、光の漏れがほとんどないため、コントラスト比がより高く見やすい反射像を映し出す鏡を実現ができる。一方、吸収型偏光選択部材２０８を用いない表示装置では、図４のように暗表示領域で多くの光漏れが生じている。

【００３７】これらのことから、本実施の形態の表示装置は、鏡状態のとき、画像表示部１０００の表示を暗表示とすることでより、視認性の良い鏡が実現できることを示す。このことは、図３，図４で光漏れを示した吸収型偏光選択部材（偏光板）２０８を備えない構成の表示装置および図４４で光漏れを示した従来の表示装置が、暗表示部の方が明表示部よりも光の漏れが多いことと対照的である。

【００３８】よって、本実施の形態では、画面全面を鏡状態とする場合には、画像表示部１０００全体を暗表示もしくは画像表示部１０００の照明装置自体を非発光状態とする。また、透過偏光軸可変部４００の一部領域のみを電圧オン状態として、画面の一部のみを鏡状態とする場合には、鏡状態とする領域と重なる領域の画像表示部１０００を暗表示もしくは非発光状態とする。これにより、鏡状態の部分からの光漏れを減少させ、高いコントラスト比の反射像を映し出すことができる。

【００３９】具体的には、鏡状態に切り替えるために、切り替えスイッチ８１３がオンに切り替えられたならば、切り替えスイッチ８１３と連動させて画像表示部１０００の液晶素子を暗表示にする回路を設けるか、もしくは画像表示部１０００の液晶素子の背面の照明装置を消灯させる回路を設ける構成にすることができる。鏡状態の場合に照明装置を消灯させるようにした場合には、表示装置の消費電力の低減が可能となる。なお、画面の一部だけを鏡状態とし、残りの部分に画像を表示する場合には、液晶素子の背面の照明装置を消灯すると画像表示領域の表示が暗くなるため、鏡状態とする領域と重なる領域の画像表示部１０００を暗表示とすることが望ましい。これにより、高コントラスト比な反射像を実現する鏡状態の実現と、明るい画像表示を同一画面上に同時に実現することが可能となる。

【００４０】また、画像表示部１０００としては、液晶素子を用いるものの他、有機エレクトロルミネッセンス（ＥＬ：electroluminescence）素子のような自発光型の表示部を用いることもできる。ＥＬ素子の反射型偏光選択部材３００と対向する位置に吸収型偏光選択部材２

０８を備える構成とする。ＥＬ素子を用いる場合には、鏡状態への切り替えと連動させて、ＥＬ素子の発光自体を止めて暗表示状態にすることにより、原理的に光の漏れをなくすことができる。これにより、高コントラスト比の反射像が得られる高品位な鏡状態を実現できるとともに、表示装置の消費電力の低減が可能となる。

【００４１】また、画像表示部１０００の照明装置の光源としてメタルハライドランプなどの放電ランプを用い、これを液晶素子とを組み合わせることにより、本実施の形態の表示装置を投射型表示装置にすることができる。この場合、放電ランプは点灯と消灯を素早く行うことができないため、鏡状態への切り替えに連動させて、画像表示部１０００の表示を暗表示とすることで光漏れを低減させる構成にすることが望ましい。

【００４２】なお、第１の実施の形態では、図１，図２のように吸収型偏光選択部材５００として、透過偏光軸が第１の直線偏光の偏光軸と平行であり、吸収偏光軸が第２の直線偏光の偏光軸と平行なものを用いたが、本発明はこれに限定されるものではなく、透過偏光軸が第２の直線偏光の偏光軸と平行であり、吸収偏光軸が第１の直線偏光の偏光軸と平行なものを用いることができる。この場合、透過偏光軸可変部４００を入射した偏光軸を変化させないで透過する状態（電圧オンの状態）に切り替えることにより、表示装置を画像透過状態に切り替え、透過偏光軸可変部４００を第１の偏光を第２の偏光へ変化させる状態（電圧オフの状態）に切り替えることにより、表示装置を鏡状態に切り替える構成となる。

【００４３】次に、本発明の第２の実施の形態の鏡状態への切り替え機能付き表示装置について、基本構成と動作を図５，図６を用いて説明する。

【００４４】第２の実施の形態の表示装置は、第１の実施の形態の図１及び図２の表示装置の吸収型偏光選択部材５００を、反射型偏光選択部材３０１と可変偏光選択部材６００との組み合わせに置き換えたものである。他の構成は、第１の実施の形態の表示装置と同様であるので、同一部には同じ符号を付け詳細な説明は省略する。

【００４５】反射型偏光選択部材３０１は、透過偏光軸可変部４００に対向する位置に配置され、反射型偏光選択部材３０１よりも観察者側に可変偏光選択部材６００が配置されている。反射型偏光選択部材３０１は、第１の直線偏光成分は反射して第２の直線偏光成分は透過する構成である。可変偏光選択部材６００は、入射した光のうち第１の直線偏光成分は吸収して第２の直線偏光成分は透過する状態と、全偏光成分を透過する状態とのいずれかを選択可能な構成である。

【００４６】第２の実施の形態の表示装置は、透過偏光軸可変部４００による偏光状態の制御と、可変偏光選択部材６００による偏光の吸収または透過の制御とにより画像表示状態と鏡状態とを切り替えられる構成としたものである。尚、観察者は可変偏光選択部材６００側から表示装置を観察する。

【００４７】ここでは、可変偏光選択部材６００として、ゲストホスト型の液晶層６０７と、液層層６０７に電圧を印加する透明電極６０３、６０６と、切り替えスイッチ６００ａとを含むものを用いる。切り替えスイッチ６００ａがオフのときには、図５のように液晶層６０７の液晶分子６０７ａの長軸が第１の直線偏光と平行になるように、液晶層６０７を配向させている。これにより、可変偏光選択部材６００は、オフ状態では、第１の直線偏光成分は吸収し、これと偏光軸が直交する第２の直線偏光成分は透過する。また、切り替えスイッチ６００ａがオンのときには、図６のように液晶分子６０７ａが透明電極６０３，６０６に垂直となるため、可変偏光選択部材６００は、全偏光成分を透過する。

【００４８】第２の実施の形態の表示装置が画像表示状態の場合の動作を図５を用いて説明する。画像表示状態にする場合、切り替えスイッチ８１３をオフにして透過偏光軸可変部４００をオフ状態とするとともに、これと連動させて切り替えスイッチ６００ａもオフにして可変偏光選択部材６００をオフ状態とする。

【００４９】画像表示部１０００から出射した画像光３００１は、反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。このとき透過偏光軸可変部４００はオフ状態であるため、通過する画像光３００１は第１の直線偏光から第２の直線偏光に変化する。透過偏光軸可変部４００を透過した画像光３００１は第２の直線偏光となっているため、偏光軸が反射型偏光選択部材３０１の透過偏光軸と一致しており、これを透過する。さらに、オフ状態の可変偏光選択部材６００の透過偏光軸とも一致しているため、これも透過し、観察者に観察される。

【００５０】一方、観察者側から画像表示状態の表示装置へ入射する外光３００２は、非偏光であるが、可変偏光選択部材６００はオフ状態であるため、可変偏光選択部材の吸収偏光軸と一致する第１の直線偏光成分は吸収され、透過偏光軸と一致する第２の直線偏光成分のみが透過する。可変偏光選択部材６００を透過した第２の直線偏光の外光３００２は、反射型偏光選択部材３０１を透過し、透過偏光軸可変部４００を透過する際、第２の直線偏光光から第１の直線偏光光に変化し、第１の反射型偏光選択部材３００を透過して画像表示部１０００の液晶層に入射する。このとき、第１の実施の形態で説明したように、暗表示領域に入射した光は、液晶層よりも照明装置側に配置されている吸収型偏光選択部材によって吸収される。よって、観察者側には戻ってこない。また、明表示領域に入射した光は、光源側の吸収型偏光選択部材も透過して照明装置に至り、一部は反射されるが、反射された光は照明光と実質的に変わりなく、照明光の一部となる。すなわち、本実施の形態の表示装置では、画像表示状態のときに、外光が入射しても、画質を

劣化させる外光の反射はほとんどない。

【００５１】従って、画像表示状態では画像光３００１はほとんど損失することなく観察者へ向かうため明るい画像が得られる。また、外光３００２は表示装置でほとんど反射されないので外光の映り込みやコントラスト比の低下といった画質劣化は生じない。

【００５２】つぎに、第２の実施の形態の表示装置が鏡状態の場合について、その動作を図６を用いて説明する。鏡状態の場合、切り替えスイッチ８１３および切り替えスイッチ６００ａを連動させてオンにし、透過偏光軸可変部４００および可変偏光選択部材６００はオン状態とする。

【００５３】鏡状態の場合、観察者側から表示装置へ入射した外光３００２は、図６のように、全ての偏光成分が可変偏光選択部材６００を透過する。可変偏光選択部材６００を透過した外光３００２は、反射型偏光選択部材３０１に入射する。反射型偏光選択部材３０１に入射した外光３００２のうち、第２の直線偏光成分は反射型偏光選択部材３０１を透過し、第１の直線偏光成分は反射型偏光選択部材３０１で反射され、再び可変偏光選択部材６００を透過して観察者側へ向かう。一方、反射型偏光選択部材３０１を透過した第２の直線偏光成分は、偏光軸が変化することなく透過偏光軸可変部４００を透過し、反射型偏光選択部材３００で反射され、再び透過偏光軸可変部４００と、反射型偏光選択部材３０１と可変偏光選択部材６００を透過して観察者側へ向う。

【００５４】このように、第２の実施の形態の表示装置では、入射した外光３００２は、反射型偏光選択部材３００及び反射型偏光選択部材３０１により、そのほとんどの偏光成分が反射される。したがって、極めて明るい反射像が得られる鏡状態が得られる。

【００５５】一方、鏡状態の場合に、画像表示部１０００から出射した画像光（明表示光）３００1は、第1の実施の形態で説明したように、吸収型偏光選択部材２０８を通過しているため、第１の直線偏光である。よって、画像光３００１は、反射型偏光選択部材３００を透過した後、透過偏光軸可変部４００を偏光軸が変化することなく第１の直線偏光のまま透過し、反射型偏光選択部材３０１で反射され、画像表示部１０００へ戻るため、ほとんど観察者には観察されない。

【００５６】なお、鏡状態における画像表示部１０００側からの光の漏れをより低減するためには、第１の実施の形態で述べたように、鏡状態となっている領域に相当する画像表示部１０００の表示領域を暗表示とすることが望ましい。表示領域全体を鏡領域とする場合には、画像表示部の照明装置を非発光状態にすることにより、光の漏れをなくすようにすることもできる。

【００５７】このように、第２の実施の形態の表示装置では、鏡状態のときに外光３００２のほとんど偏光成分が反射されるため、極めて明るい反射像が得られるとともに、画像光３００１の光漏れが少なく、見やすい鏡が得られる。また、画像表示状態の場合には、第１の実施の形態と同様に、外光の映り込みこみが少なく、しかも、明るい画像を表示できる。

【００５８】なお、第２の実施の形態では、第２の反射型偏光選択部材３０１として、図５，図６のように反射偏光軸が第１の直線偏光の偏光軸と平行であり、透過偏光軸が第２の直線偏光の偏光軸と平行なものを用いたが、本発明はこの構成に限られるものではなく、反射偏光軸が第２の直線偏光の偏光軸と平行であり、透過偏光軸が第１の直線偏光の偏光軸と平行なものを用いることができる。この場合、透過偏光軸可変部４００を、入射した偏光軸を変化させないで透過する状態（電圧オン状態）に切り替えるとともに、可変偏光選択部６００を、第２の直線偏光を吸収し第１の直線偏光を透過する状態（電圧オフ状態）に切り替えることにより、表示装置を画像透過状態に切り替え、透過偏光軸可変部４００を、第１の直線偏光を第２の直線偏光へ変化させる状態（電圧オフ状態）に切り替えるとともに、可変偏光選択部６００を、全偏光成分を透過する状態（電圧オン状態）に切り替えることにより、表示装置を鏡状態に切り替える構成にすることができる。

【００５９】尚、上述の第１および第２の実施の形態では、画像表示部１０００として液晶素子を用いる場合に、照明装置を含む透過型の液晶素子について説明したが、反射型の液晶素子を用いることも可能である。

【００６０】また、画像表示部材を構成する吸収型偏光選択部材２０８の偏光度をＰ１、吸収型偏光選択部材５００の偏光度をＰ２とした場合、０．９６６≦Ｐ１≦０．９９５≦Ｐ２の関係を満たすか、もしくは０．９６６≦Ｐ２≦０．９９５≦Ｐ１の関係を満たすことが望ましい。この理由については、後述の実施例２で説明する。

【００６１】また、第１および第２の実施の形態の表示装置において、吸収型偏光選択部材５００、２０８の表面および可変偏光選択部材６００の最表面に反射防止膜を形成することが好ましい。

【００６２】また、本発明では反射型偏光選択部材３００と反射型偏光選択部材３０１との間隔を０．１１ｍｍ以下とすることが好ましい。この理由については、後述の実施例２で説明する。

【００６３】また、本発明では表示装置を鏡状態にした場合、少なくとも５８．６ｍｍ×３９．１ｍｍの領域全域が実質的に鏡となるように構成することが好ましい。これは、成人男性の顔の４分の１を映すことを考慮して定めた大きさである。これについても、後述の実施例で説明する。

【００６４】また、第１および第２の実施の形態において、反射型偏光選択部材３００，３０１としてフィルム状の部材を使用することができる。この場合、フィルム

状の部材を透明な粘着剤を介して、剛性が高く、平坦、かつ透明で光学的に等方な透明基板に直接粘着するか、或いは平坦なフィルム等を介して間接的に粘着固定して、反射面に歪みがないように構成することが望ましい。

【００６５】また、第１および第２の実施の形態の表示装置を、投射装置から出射した投射光がミラー部材を介して透過型スクリーンに照射される投射方式の表示装置にすることができる。この場合、透過型スクリーンに、鏡機能部を備える構成としても良い。この場合、投射装置は投射光として各色光の偏光状態が一致した直線偏光を出射するものとし、さらに、該直線偏光光がミラー部材の反射面に対してｓ偏光光、或いはｐ偏光光となるよう構成する。

【００６６】さらにまた、前記透過型スクリーンを構成する鏡機能部および光学系のうち、鏡機能部を着脱可能な構造として、鏡機能が不要なときには鏡機能部を取り外す構成とすることができる。あるいは、画像表示部を含まず鏡機能部を独立して備えたスクリーンを構成し、この鏡機能スクリーンを任意の表示装置に必要に応じて装着する構成としても良い。

【００６７】第１および第２の実施の形態において、反射型偏光選択部材３００，３０１として、千数百オングストローム（$10^{-10}$m）のピッチで導電性の金属線状パターンを配置した構成のもの用いることができる。このとき、金属線状パターンの長手方向が反射偏光軸となる。また、透明基板上に千数百オングストローム（$10^{-10}$m）のピッチで導電性の金属線状パターンを形成し、さらに隣り合う線状パターンの一部を電気的に接続したもので、透明電極と反射型偏光選択部材とを兼用させることができる。これにより、透明電極６０６と反射型偏光選択部材３０１、または、反射型偏光選択部材３０１と透明電極４０３、または、透明電極４０６と反射型偏光選択部材３００を構成することができる。

【００６８】上記第１および第２の実施の形態において、画像表示部材１０００は、以下のような構造にすることができる。すなわち、一定の間隙をもって接合された一対の透明基板と、これら透明基板間に挟持された液晶層と、前記一対の透明基板の少なくとも一方に透明電極により形成されるマトリクス状に配置された画素電極群と、観察者側に配置される吸収型偏光選択部材２０８と、観察者側とは反対側の透明基板に配置される吸収型偏光選択部材とを含む液晶素子、前記画素電極群に画像信号に対応した電圧を印加する表示用液晶素子駆動部、前記表示用液晶素子の背面に配置した照明装置を備えた構成とすることができる。このとき、照明装置の点灯、消灯を切り替えスイッチ８１３に連動させて切り替える切替え部を備える構成にすることができる。照明装置は、複数の色光を順次発光する光源を有し、液晶素子は照明装置からの色光に対応して、フィールド順次カラー表示を行う構成とすることができる。

【００６９】また、画像表示部１０００として、反射型液晶素子を用いる構成とすることもできる。この場合、反射型液晶素子としては、透明基板と、反射部を備える反射基板とを、ビーズ等のスペーサを介して張り合わせ、枠状のシール材により周囲をシールし、前記２枚の基板の間隙に液晶を封入して封止したものを用いることができる。このとき、透明基板には、位相差板を積層して配置する。なお、透明基板または反射基板にカラーフィルタを備えることができる。このカラーフィルタは暗表示での暗さを高める機能を備えていることが好ましく、具体的にはデルタ配列のカラーフィルタを用いることがより望ましい。

【００７０】また、第１および第２の実施の形態の表示装置において、鏡状態となる領域と画像表示状態での画像表示領域の大きさが異なるように構成することができる。また、画像表示部１０００として、一部の表示領域で透過型として機能し、それ以外の領域では反射型として機能する表示用液晶素子と、前記透過型として機能する領域を照明するための照明装置とを備える構成のものを用いることができる。

【００７１】また、第１および第２の実施の形態の表示装置において、画像表示部の表示領域を複数に領域に分割し、各分割領域毎に鏡状態と画像表示状態との切替制御を行う構成としても良い。これを実現するために、透過偏光軸可変部４００や可変偏光選択部材６００の光透過面を、複数の領域に分割し、個別領域ごとに透過する光の偏光軸を変化させる状態と変化しない状態との選択制御や、吸収すべき偏光光の選択制御を行う構成にすることができる。

【００７２】

【実施例】以下、本発明の実施例を説明する。

【００７３】（実施例１）本発明の実施例１の、鏡状態への切り替え機能付き表示装置を図７，図８を用いて説明する。本実施例１の表示装置は、基本構成が第１の実施の形態の図１、図２に示した表示装置と同様である。

【００７４】第１の実施の形態と同様に、実施例１の図７の表示装置は、順に重ねられた、画像表示部１０００と、反射型偏光選択部材３００と、透過偏光軸可変部４００と、吸収型偏光選択部材５００とを有している。これらは、開口１０７１を有する筐体１０７０内に収容されている。開口１０７１が、鏡状態に切り替え可能な画像表示部となる。各部の作用は、第１の実施の形態で説明した通りである。

【００７５】画像表示部１０００は、図７，図８に示したように、表示用液晶素子を含み、光の透過光量を調節することで画像を表示する液晶表示パネル２００と、その背面に配置した照明装置１００とを有する。液晶表示パネル２００としてはＴＮ（Twisted Nematic）モード、ＳＴＮ（Super Twisted Nematic）モード、ＥＣＢ

（Electrically Controlled Birefringence）モード等の表示モードを用いた液晶表示パネルを用いることが望ましい。このような、液晶表示パネルは偏光板を用いて液晶層に入射する光の偏光状態を変調することで表示を行うため、比較的低い駆動電圧で高いコントラスト比が得られる。また、液晶表示パネル２００の反射型偏光選択部材３００側に配置される吸収型偏光選択部材２０８として機能する偏光板により、画像光として直線偏光光が出射する。

【００７６】尚、液晶表示パネル２００は、一般的に知られているように、ＴＦＴ（Thin Film Transistor）等のスイッチング素子を用いたアクティブマトリクス駆動による液晶表示パネルと、マルチプレックス駆動の液晶表示パネルとの２方式があり、いずれかを選択して用いることができる。具体的にはＴＮ（Twisted Nematic）液晶表示パネルや、ＩＰＳ（In Plane Switching）液晶表示パネル、ＭＶＡ（Multi-domain Vertical Aligned）液晶表示パネル等のアクティブマトリクス駆動による液晶表示パネル、或いはＳＴＮ（Super Twisted Nematic）液晶表示パネル等のマルチプレックス駆動の液晶表示パネルを用いることができる。実施例１では、液晶表示パネル２００としてＴＮ液晶表示パネルを用いる場合について説明するが、本発明はこれに限定されるものではない。

【００７７】図８を用いて、実施例１の表示装置の各部の詳しい構成について説明する。

【００７８】照明装置１００は、液晶表示パネル２００の画像表示部を均一に照明できるものを用いる。照明装置としては、エッジライト方式（導光体方式）、直下方式（反射板方式）、面状光源方式等（液晶ディスプレイ技術、ｐ２５２−２５６、産業図書株式会社、発行日１９９６年１１月８日：フルカラー液晶表示技術、ｐ２０１−２０２、株式会社トリケップス、発行日１９９０年２月２６日）が一般的には知られている。照明装置１００としては、これらの方式やその他の方式の中から用途や目的、画面サイズに合わせて最適な方式を選べば良い。ここでは、照明装置１００としてエッジライト方式のものを用いた場合について説明するが、本発明はこれに限定されるものではない。

【００７９】照明装置１００は、裏面に白色顔料によるドット印刷１０５等の処理を施した透明なアクリル樹脂からなる導光体１０３と、導光体１０３の端面に配置した例えば冷陰極管からなる線状光源１０１と、ランプカバー１０２と、導光体１０３の裏面に配置した反射シート１０４と、導光体１０３の前面に配置した拡散シート１１０，１１２と、プリズムシート１１１とを有している。

【００８０】この構成において、光源１０１から出射した光は直接、或いはランプカバー１０２で反射した後、導光体１０３に入射する。導光体１０３に入射した光１０１は全反射しながら導光体１０３内を伝播するが、導光体１０３の裏面に施された白色顔料によるドット印刷１０５に至った光は、その進行方向が変わり、導光体１０３表面側から出射する。導光体１０３から出射した光は、拡散シート１１０、１１２、及びプリズムシート１１１等により出射角度分布や、面内での輝度分布が均一化された後、液晶表示パネル２００に照射される。

【００８１】液晶表示パネル２００は、図８のように、平坦かつ透明で光学的に等方なガラス或いはプラスチックからなる第１の透明基板２０１および第２の透明基板２０２とを含んでいる。透明基板２０１には、カラーフィルタ（不図示）、ＩＴＯ（Indium Tin Oxide）からなる透明電極２０３、及び、ポリイミド系高分子からなる配向膜２０４が積層されている。第２の透明基板２０２には、配向膜２０６、画素を形成する透明電極２０５、および、これと接続される電極や薄膜トランジスタ等のスイッチング素子（不図示）が形成されている。２枚の透明基板２０１、２０２を配向膜２０４，２０６が形成されている面を向かい合わせ、２枚の透明基板２０１、２０２の間に図示しないスペーサーを介して一定の間隙を設け、さらに枠状のシール材２１０で周囲を封止して内部に空間を形成している。この空間に誘電異方性が正のネマチック液晶を封入することにより、液晶層２０７が設けられている。

【００８２】液晶層２０７の液晶分子の長軸の配向方向は、２枚の透明基板２０１、２０２上に形成された配向膜２０４，２０６にラビング等の配向処理を行なうことで規定されている。ここでは、透明基板２０１，２０２間で連続的に９０°ねじれた状態となっている。透明基板２０２の背面と、透明基板２０１の前面にはそれぞれ偏光板２０９及び吸収型偏光選択部材（偏光板）２０８が、互いに偏光軸が直交する直線偏光を透過するように配置されている。透明基板２０２側及び透明基板２０１側の液晶分子の長軸の配向方向は、偏光板２０９及び吸収型偏光選択部材（偏光板）２０８の透過偏光軸に対して、共に平行、もしくは共に直交するように構成している。

【００８３】吸収型偏光選択部材（偏光板）２０８および偏光板２０９としては、例えば延伸したポリビニルアルコールにヨウ素を吸収させることにより偏光機能を付与した膜の両面に、トリアセチルセルロースの保護層を施したものを用いることができる。なお、吸収型偏光選択部材（偏光板）２０８および偏光板２０９は、それぞれ透明基板２０２及び透明基板２０１に、アクリル系の接着剤により光学的に結合するよう接着する。

【００８４】このような構成により、液晶表示パネル２００の背面（照明装置１００側）から入射する照明光のうち、偏光板２０９を透過した直線偏光は、液晶層２０７を通過して吸収型偏光選択部材（偏光板）２０８に入射する。この際、液晶層２０７を透過する光の偏光状態

は、液晶層２０７に印加する電圧によって変化させることができる。よって、画像情報発生部（不図示）から伝えられる画像情報に対応した電圧を透明電極２０３、２０５に印加して、液晶層２０７に電界を印加することで、液晶層２０７を通過する光の偏光状態を変え、吸収型偏光選択部材（偏光板）２０８を透過する光量を制御することができる。これにより、直線偏光光からなる所望の画像光を形成することができる。

【００８５】つぎに、反射型偏光選択部材３００について説明する。

【００８６】反射型偏光選択部材３００は、画像表示部１０００から出射する第１の直線偏光成分は透過し、これと直交する偏光軸を有する第２の直線偏光成分は鏡面反射する機能を有するものを使用する。そのような部材としては、例えば国際出願の国際公開番号：ＷＯ９５／２７９１９号に開示されている異なる複屈折性高分子フィルムを交互に複数層積層した複屈折反射型偏光フィルム、或いは、コレステリック液晶層の表と裏に１／４波長板を配置したものを用いることができる。複屈折反射型偏光フィルムの場合、所定の直線偏光成分は透過し、これと偏光軸が直交する直線偏光成分は鏡面反射するフィルムが３Ｍ社（米国）からＤＢＥＦという商品名で市販されており、これを反射型偏光選択部材３００として使用することができる。尚、反射型偏光選択部材３００は、本表示装置を鏡状態にする場合に鏡面として機能する重要な部材であるため、マット処理等のように反射像をぼかすような処理がなされていないものを使用する。

【００８７】一方、反射型偏光選択部材３００として、コレステリック液晶層の表と裏に１／４波長板を配置したもので構成する場合、配向処理された２枚の透明基板間に低分子コレステリック液晶を収めた液晶セルや、高分子コレステリック液晶層をガラス或いは透明樹脂等の平坦かつ光学的に等方で透明な基板上に形成したものを、コレステリック液晶層として使用することができる。コレステリック液晶層は、ヘリカルな分子配列に基づく特異な光学特性を示すもので、ヘリカル軸に平行に入射した光が、コレステリック螺旋の回転方向に応じて、一方の回転方向の円偏光は反射し、他方は透過するという選択反射を示すものである。選択反射の波長域は、分子配列のピッチによって決まるので、可視波長域全域で選択反射が起こるようにするためには、ピッチの異なる複数のコレステリック液晶層を積層して用いることが必要である。この場合、可視波長域全域で選択反射を得るために、ピッチの異なるコレステリック液晶層を複数層重ねる代わりにAsia Display95 Digest, p735, The Institute of Television Engineers of Japan (ITE) &The Society for Information Display (SID) に記載されているようなピッチを連続的に変化させたコレステリック液晶層を用いてもよい。

【００８８】反射型偏光選択部材３００として、コレステリック液晶層の表と裏に１／４波長板を配置したものを用いる場合、コレステリック液晶層の裏側、すなわち画像表示部１０００側に配置される１／４波長板は、その遅相軸をつぎのような方向に設定する。すなわち、画像表示部１０００から出射して、反射型偏光選択部材３００に入射する第１の直線偏光を、コレステリック液晶層を透過する円偏光に変換するように、その遅相軸を配置する。一方、同じくコレステリック液晶層の表側、すなわち透過偏光軸可変部４００側に配置される１／４波長板は、コレステリック液晶層を透過する円偏光が第１の直線偏光へ変換されるように、その遅相軸を配置する。

【００８９】このようにコレステリック液晶層の表と裏に１／４波長板を配置した構成の反射型偏光選択部材に第２の直線偏光が入射した場合、第２の直線偏光は、１／４波長板の作用で、コレステリック液晶層を透過する円偏光とは逆周りの円偏光に変換されるため、コレステリック液晶層で選択反射される。コレステリック液晶層で反射した円偏光は、再び１／４波長板を透過する際、その作用で第２の直線偏光に変換される。

【００９０】尚、この構成の反射型偏光選択部材３００に使用する１／４波長板は、可視波長の全域に於いて１／４波長板として機能するものを用いることが望ましい。１／４波長板としては、可視波長域において高い透過率を有する、延伸した高分子フィルム、例えばポリビニルアルコール、ポリカーボネート、ポリサルフォン、ポリスチレン、ポリアリレート等を用いることができる。この他にも雲母や水晶または分子軸を一方向に揃えて配向した液晶層等を用いることができる。

【００９１】また、一般に１／４波長板を構成する材質の屈折率の波長依存性（以下、波長分散）により、一種類の位相差板で可視波長の全域に対し１／４波長板として機能する位相差板を構成することは困難であるが、波長分散の異なる少なくとも２種類の位相差板をその光学軸を直交するように貼り合わせることで広い波長域で１／４波長板として機能するよう構成したものを使用するようにすればよい。

【００９２】尚、反射型偏光選択部材３００として、複屈折反射型偏光フィルム、もしくはフィルム状のコレステリック液晶層と１／４波長板の積層部材のように、フィルム状の部材を用いる場合は以下の点に注意する。

【００９３】すなわちフィルム状の反射型偏光選択部材は、そのままでは平坦性が低いため単に画像表示部１０００の前面に配置しただけでは、ゆがみが多く、実用上満足な鏡を実現するのは困難である。そこで、反射型偏光選択部材３００としてフィルム状の部材を使用する場合は、透明な粘着剤を介して、ガラス板あるいはプラスチック板等のように剛性が高く、平坦、かつ透明で光学的に等方な透明基材に粘着固定し、歪みがないようにすることが望ましい。

【００９４】あるいは反射型偏光選択部材３００を平坦な状態で固定するために、新たな透明基材に粘着固定する代わりに、液晶表示パネル２００或いは後述の透過偏光軸可変部４００の透明基板に固定する構成にすることができる。いずれにしても、反射型偏光選択部材３００としてフィルム状の部材を用いる場合は、歪みの無い鏡を実現するために、別の平坦な部材に粘着固定することが望ましい。

【００９５】つぎに、透過偏光軸可変部４００について説明する。

【００９６】透過偏光軸可変部４００は、入射した直線偏光光が透過する際に、その偏光状態を変化させて、入射した直線偏光とは偏光軸が直交する直線偏光光へ変化させる状態と、偏光状態を変化させない状態のいずれかを選択可能な構成であり、例えば図８に図示するような液晶素子を用いることができる。

【００９７】この透過偏光軸可変部４００は、ＩＴＯからなる透明電極４０３、及びポリイミド系高分子からなる配向膜４０４が全面的に積層形成された第１の透明基板４０１と、同じく透明電極４０６、及び配向膜４０５が全面的に積層形成された第２の透明基板４０２と、液晶層４０７とを含む。尚、２枚の透明基板４０１，４０２にそれぞれ形成された透明電極４０３、４０６は、図示しない配線、及び切り替えスイッチ８１３（図１参照、図８では不図示）を介して電源に接続されている。よって、透明電極４０３、４０６に電圧を印加しない状態と、電圧を印加する状態のいずれかの状態を選択可能に構成されている。つまり、透明電極４０３，４０６に電位差がなく、液晶層４０７に電界が印加されない状態と、透明電極４０３，４０６に電圧を印加し、液晶層４０７に電界が印加される状態のいずれかの状態を選択可能に構成されている。

【００９８】透過偏光軸可変部４００の液晶層４０７は、２枚の透明基板４０１，４０２を配向膜の形成面が向かい合うように配置し、図示しないスペーサーを挟むことで２枚の透明基板４０１、４０２の間に一定の間隙を設け、この間隙の周囲をシール材４１０で枠状にシールして空間を形成し、この空間に誘電異方性が正のネマチック液晶を封入することで構成する。

【００９９】尚、ここでは透過偏光軸可変部４００として、２枚の透明基板４０１，４０２に形成した配向膜４０４，４０５にそれぞれラビング処理等の配向処理を行い、液晶層４０７の液晶分子長軸を２枚の透明基板４０１，４０２間で連続的に９０°捩じれるよう構成した、いわゆるＴＮ液晶素子の場合を説明する。

【０１００】この場合、透明基板４０２側の液晶分子長軸の配向方向は液晶表示パネル２００の吸収型偏光選択部材（偏光板）２０８の直線偏光透過偏光軸と平行、もしくは直交するように構成し、液晶層４０７は可視波長域においてウエーブガイドの条件を満たすように構成する。ウエーブガイドの条件は、例えばJ. Phys. D: Appl. Phys. Vol.8 (1975)の第１５７５〜１５８４頁のC. H. GoochとH. A. Tarryによる論文に記載されている。

【０１０１】ここでは液晶の複屈折をΔｎ、液晶層の厚さをｄとした場合、ｄ·Δｎ＝０．４４５２（波長６３３ｎｍ）とした。

【０１０２】上記構成により本実施例の透過偏光軸可変部４００は、２枚の透明基板４０１，４０２にそれぞれ形成された透明電極４０３，４０６に電位差がなく、液晶層４０７に電界が印加されないオフ状態では、画像表示部１０００から出射し、反射型偏光選択部材３００を透過した第１の直線偏光はこれと偏光軸が直交する第２の直線偏光光へ変化する。一方、２枚の透明基板４０１，４０２にそれぞれ形成された透明電極４０３，４０６に電圧を印加し、液晶層４０７に電界が印加されるオン状態では画像表示部１０００から出射し、反射型偏光選択部材３００を透過した第１の直線偏光光はその偏光軸が変化することなく透過する。この際、透明電極４０３，４０６に印加する電圧は±５Ｖ、６０Ｈｚであれば十分に機能した。

【０１０３】尚、実施例１では、透過偏光軸可変部４００としてＴＮ液晶素子の場合を示したが、本発明はこれに限定されるものではない。すなわち透過偏光軸可変部４００は入射した直線偏光光が透過する際にその偏光軸を変化させて入射した直線偏光光とは偏光軸が直交する直線偏光光へ変化させる状態と、偏光軸を変化させない状態のいずれかの状態に選択可能な部であれば良く、上記ＴＮ液晶素子の他にＥＣＢ（Electrically Controlled Birefringence）液晶素子、強誘電液晶素子、反強誘電液晶素子等を用いることができる。

【０１０４】つぎに、吸収型偏光選択部材５００について説明する。

【０１０５】吸収型偏光選択部材５００は入射した光のうち第１の直線偏光成分は吸収し、これと偏光軸が直交する第２の直線偏光成分は透過する、もしくは第１の直線偏光成分は透過し、第２の直線偏光成分は吸収する機能を有するもので、いわゆる偏光板を用いることができる。つまり、吸収型偏光選択部材５００としては、例えば延伸させたポリビニルアルコールにヨウ素を吸収させて偏光機能を付与した膜の両面に、トリアセチルセルロースの保護層を施した偏光板を用いることができる。

【０１０６】尚、吸収型偏光選択部材５００は、映り込みによる画質の劣化を抑えるために、その表面に正反射を抑える処理を施すことが望ましい。但し、ここで重要なのは本発明の表示装置は鏡としても機能するため、吸収型偏光選択部材５００の正反射防止の処理として、表面に微細な凹凸を形成する、或いは表面に透明微粒子を含有する透明樹脂層を形成するなどして正反射成分を低減する方法は望ましくない。なぜなら、このような処理をした場合、映り込みの低減により画像表示性能は向上

するが、鏡に映る像がぼけてしまい鏡の性能が劣化するという問題が生じるからである。

【０１０７】従って、吸収型偏光選択部材５００の正反射防止の処理としてはその表面に反射防止膜を形成することが望ましい。反射防止膜としては公知の技術を用いることができる。即ち、光学設計された屈折率の異なる数種の金属酸化物を蒸着により多層コートする方法、或いはフッ素化合物などの低屈折率材料を塗布する方法を用いれば良い。

【０１０８】つぎに、本実施例の表示装置の各部材の軸の方向について、図９を用いて説明する。

【０１０９】ここでは、吸収型偏光選択部材５００は、入射した光のうち第１の直線偏光成分は吸収し、これと偏光軸が直交する第２の直線偏光成分は透過する場合を示す。尚、各軸の角度は画像表示面の水平方向３時の位置を基準とし、ここから逆時計周りの角度で示している。図９に示す通り、画像表示部１０００を構成する液晶表示パネル２００として、ＴＮ液晶表示パネルを用いた場合は、視角特性の水平方向の対称性を得るため、通常、偏光板の直線偏光の透過偏光軸は１３５°（または４５°、本実施例では１３５°）とする。従って、反射型偏光選択部材３００の直線偏光の透過偏光軸も同じく１３５°、透過偏光軸可変部４００の透明基板４０２側と、透明基板４０１側の液晶分子長軸の配向方向はそれぞれ１３５°と４５°、吸収型偏光選択部材５００の直線偏光の透過偏光軸は４５°とする。

【０１１０】次に、本実施例１の表示装置の動作を、図１０および図１１を用いて説明する。

【０１１１】実施例１の表示装置が画像表示状態の場合について、図１０を用いて説明する。表示装置が画像表示状態の場合、透過偏光軸可変部４００は、これを構成する液晶層４０７に電圧を印加しない状態、すなわちオフ状態となるよう、切り替えスイッチ８１３をオフとする。画像表示部１０００の照明装置１００から出射し、液晶表示パネル２００の吸収型偏光選択部材（偏光板）２０８を透過した直線偏光は、画像光３００１として画像表示部１０００から出射される。この第１の直線偏光からなる画像光３００１は、反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。透過偏光軸可変部４００を通過する画像光３００１は第１の直線偏光から第２の直線偏光に変化する。透過偏光軸可変部４００を透過した第２の直線偏光の画像光３００１は、吸収型偏光選択部材５００に入射する。吸収型偏光選択部材５００は第１の直線偏光成分は吸収し、第２の直線偏光成分は透過するため、第２の直線偏光の画像光３００１は吸収型偏光選択部材５００を透過して、観察者に観察される。

【０１１２】一方、観察者側（図中左側）から表示装置へ入射する外光３００２は、非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。吸収型偏光選択部材５００を透過した外光３００２は透過偏光軸可変部４００を透過する際、第２の直線偏光から第１の直線偏光に変化し、反射型偏光選択部材３００を透過して画像表示部１０００に向かう。この光は、第１の実施の形態で説明した通り、ほとんど観察者側へは戻ってこない。

【０１１３】従って、画像表示状態では、画像表示部１０００から出射した画像光３００１はほとんど損失することなく観察者へ向かうため明るい画像を得ることができる。さらに、外光３００２は鏡状態の場合に鏡として機能する反射型偏光選択部材３００で反射されることがないので映り込みや、コントラスト比の低下といった外光に起因した画質の劣化がほとんど起こらない。

【０１１４】図１１は、本表示装置が鏡状態の場合を示す。本表示装置が鏡状態の場合、透過偏光軸可変部４００は、これを構成する液晶層４０７に電界を印加するオン状態とするように、切り替えスイッチ８１３をオンにする。この場合、観察者側から本表示装置へ向かう外光３００２は、非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過し、透過偏光軸可変部４００に入射する。このとき透過偏光軸可変部４００に入射した外光３００２は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光光のまま透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００は第１の直線偏光成分は透過し、第２の直線偏光成分は鏡面反射するため、外光３００２は反射型偏光選択部材３００で反射する。反射型偏光選択部材３００で反射した外光３００２は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、さらに偏光選択部材５００も透過して観察者へ向かうため鏡状態が実現する。

【０１１５】この際、本実施例の画像表示部１０００では、吸収型偏光選択部材（偏光板）２０８を備えているため、暗表示領域の画像光は、吸収型偏光選択部材（偏光板）２０８により吸収され、反射型偏光選択部材３００に至ることがない。よって、反射型偏光選択部材３００の反射性能の如何に関わらず、暗表示部領域から光の漏れを大幅に低減することができる。

【０１１６】また、画像表示部１０００から出射する画像光のうち、明表示領域から出射される画像光３００１は、反射型偏光選択部材３００を透過して透過偏光軸可変部４００に入射する。本表示装置が鏡状態の場合、透過偏光軸可変部４００はオン状態であり、このとき透過偏光軸可変部４００を透過する画像光３００１は、偏光軸が変化することなく第１の直線偏光光のまま透過するため、吸収型偏光選択部材５００で吸収されて観察者にはほとんど観察されない。

【０１１７】つまり、鏡状態の場合には画像表示部材か

らの光は観察者に至ることがなく、一方、周囲から表示装置に入射する外光３００２は理想的には非偏光の半分の光が反射型偏光選択部材３００で反射して、観察者側に向かうため明るい鏡として機能する。

【０１１８】また、本実施例の表示装置は、鏡状態のときに、透過偏光軸可変部４００をオンにして、液晶分子４０７ａを立たせる構成である。一般にネマティック型液晶は、電圧オンの液晶分子を立たせた状態の方が、電圧オフの液晶分子が捻れた状態のときよりも、斜め方向に出射させる光の偏光軸のずれは小さい。このため、本実施の形態の表示装置は、従来の技術で述べた鏡状態で電圧オフにする構成のものと比較して、鏡状態のときに画像光（明表示光）３００１の斜め方向への光漏れが少ないという効果も得られる。

【０１１９】尚、吸収型偏光選択部材２０８や吸収型偏光選択部材５００として機能する偏光板の特性は、画像表示状態の画質や鏡状態の鏡の見え易さに直接関係する。具体的には、偏光板の透過率は画像表示状態での画像の明るさと、鏡状態での反射像の明るさに寄与するため、高いことが望ましい。また、偏光板の偏光度は、画像表示状態でのコントラスト比と外光の不要な反射の量に直接関係している。偏光板の偏光度が高いほど、画像表示のコントラスト比が高くなり、外光の不要な反射が小さくなることから、偏光板の偏光度は高いことが望ましい。鏡状態においても偏光度が高いほど画像表示部材からの光の漏れが小さくなり反射像のコントラスト比が向上してより見え易い鏡状態が実現されるため、偏光板の偏光度はより高いことが望ましい。

【０１２０】従って、吸収型偏光選択部材２０８や吸収型偏光選択部材５００として用いる偏光板は高透過率でなおかつ高偏光度の偏光板を用いることが望ましい。しかし、一般に偏光板の透過率と偏光度との間には図１２に例示するようなトレードオフの関係が存在する（日東技報、Vol38, No.1,May,2000,pp11-14）。図１２はヨウ素系偏光板の透過率と偏光度の一般的な関係を示すグラフであり、横軸が偏光板の透過率、縦軸が偏光度を示す。このため、吸収型偏光選択部材２０８と吸収型偏光選択部材５００として用いる偏光板の特性の選択が、画像表示状態の画質と鏡状態での鏡性能の両立に極めて重要となる。

【０１２１】図3、及び図4は鏡状態における画像表示部１０００からの光の漏れを示すグラフである。図3が明表示部、図4が暗表示部の光の漏れの大小を輝度値で表す。これらのグラフは表示装置が画像表示状態の場合に、輝度値4５0cd/m²の明表示を行う条件でのデータであり、横軸が表示装置表示部上の位置を示し、縦軸が正面方向での輝度値を示す。また、図中Ａタイプ偏光板、Ｂタイプ偏光板、Ｃタイプ偏光板が吸収型偏光選択部材２０８として用いた偏光板のタイプを示し、比較のため吸収型偏光選択部材２０８をなくし、他の構成は本実施例１の表示装置と同じにした場合の光漏れも併記している。図3，図4のＡタイプ偏光板は透過率41.5%、偏光度99.97%、Ｂタイプ偏光板は透過率43.6%、偏光度99.5%、Ｃタイプ偏光板は透過率45.4%、偏光度96.60%である。尚、図3および図4のデータは、吸収型偏光選択部材５００として、Ａタイプ偏光板を用いている。

【０１２２】図3および図4に示すとおり、Ａタイプ、Ｂタイプ、Ｃタイプのどの偏光板であっても吸収型偏光選択部材２０８を備えたことで、吸収型偏光選択部材２０８がない場合と比較して、光の漏れが著しく低減しており、コントラスト比の高い反射像を映し出す鏡が実現ができることがわかる。特に、偏光度が99.5%以上のＡタイプおよびＢタイプ偏光板の場合、図4に示す通り暗表示部での光の漏れが著しく低減して、コントラスト比がより高い反射像を映し出す高品位な鏡状態が実現ができることがわかる。

【０１２３】従って、吸収型偏光選択部材２０８として用いる偏光板の偏光度は、少なくとも96.60%以上であることが望ましく、より高品位な鏡状態を実現するために偏光度が99.5%以上であることがより望ましい。

【０１２４】一方、図１３は吸収型偏光選択部材５００として用いる偏光板の偏光度と、鏡状態での鏡の反射率、及び画像表示状態での外光の反射率（不要反射率）との関係を示すグラフである。横軸が、吸収型偏光選択部材５００として用いる偏光板の偏光度、縦軸が反射率を示す。図１３の通り、吸収型偏光選択部材５００として用いる偏光板の偏光度を99.97%から96.60%と下げて、より高透過率なものとすることで、鏡状態での反射率が約１０％向上し、より明るい鏡が実現できる。この際、画像表示状態での不要反射率の増加は小さかった。

【０１２５】図14は、吸収型偏光選択部材２０８として用いる偏光板の偏光度と画像表示状態における明表示の輝度値の関係の一例を示すグラフであり、横軸が偏光板の偏光度、縦軸が相対輝度を示す。尚、図14のデータは、吸収型偏光選択部材５００としてＡタイプ偏光板を用いている場合のデータである。図１４の通り、吸収型偏光選択部材２０８として用いる偏光板の偏光度を、99.97%から96.60%と低下させて、高透過率のものとすることで輝度値が約9.5%上昇し、より明るい画像が得られた。この関係は吸収型偏光選択部材２０８の偏光板の特性を固定し、吸収型偏光選択部材５００の偏光板の偏光度を変えた場合も同じであった。

【０１２６】また、吸収型偏光選択部材２０８および吸収型偏光選択部材５００のうちのどちらか一方に偏光度が99.5%以上の偏光板を用いれば、他方の偏光板の偏光度が96.6%以下であっても十分なコントラスト比が得られた。従って、画像表示状態において十分なコントラスト比を維持しつつ、輝度を向上するためには吸収型偏光選択部材２０８および吸収型偏光選択部材５００のうちのどちらか一方の偏光板に偏光度の高い偏光板を用い、

他方に偏光度の低い偏光板を用いることが有効である。

【０１２７】以上から、吸収型偏光選択部材２０８の偏光板の偏光度をＰ１とし、吸収型偏光選択部材５００の偏光板の偏光度をＰ２とした場合、画像表示状態における表示画像の明るさとコントラスト比、及び鏡状態における反射像のコントラスト比と明るさを高いレベルで両立するために以下の条件を満足することが望ましい。

条件１　0.966≦Ｐ１≦0.995≦Ｐ２。

条件２　0.966≦P2≦0.995≦P1を満足し、鏡状態では必ず画像表示部材を暗表示とする。

【０１２８】尚、条件２で鏡状態では必ず画像表示部材を暗表示とするとした理由は、吸収型偏光選択部材５００の偏光板の偏光度が低い場合、明表示領域からの光の漏れが大きくなり、反射像のコントラスト比が著しく低下してしまうからである。そこで、暗表示とすることにより、光の漏れを防止し、コントラスト比の低下を防止する。

【０１２９】尚、本実施例１の表示装置では、照明装置１００の点灯、消灯を、透過偏光軸可変部４００の切り替えスイッチ８１３の切り替えと連動させる切替え部を設けて、全面鏡状態の場合に照明装置を消灯するようにしてもよい。この場合、画像表示部１０００から光は出力されないので光の漏れがなくコントラスト比が高い反射像が得られる見やすい鏡を実現できるとともに、消灯した分だけ表示装置の消費電力が低減できるといった効果もある。

【０１３０】また、画面の一部だけを鏡状態とし、残りの部分に画像を表示する場合には、照明装置は消灯せず、鏡状態の領域に該当する画像表示部１０００の領域を暗表示とすることで高コントラスト比な反射像を実現する鏡の実現と、明るい画像表示領域を同一画面上に実現することができる。

【０１３１】上記の通り、本発明の表示装置によれば、反射型偏光選択部材３００は、透過偏光軸可変部４００による偏光状態の制御により、実効的に透明な状態と、鏡として機能する状態とに切り換えられる。従って、画像表示状態では反射型偏光選択部材３００を実効的に透明な状態とすることで明るい画像が得られる。また、周囲が明るい環境であっても、外光は表示装置でほとんど反射されないので、ハーフミラーを使用する場合のような映り込みや、それに伴うコントラスト比の低下といった画質の劣化が生じない。つまり、画像表示状態と鏡状態の切り換えを互いの性能を劣化することなく実現できる。

【０１３２】また、本実施例の画像表示部１０００では、吸収型偏光選択部材（偏光板）２０８を備えているため、暗表示領域の画像光は、吸収型偏光選択部材（偏光板）２０８により吸収され、反射型偏光選択部材３００に至ることがない。よって、反射型偏光選択部材３００の反射性能の如何に関わらず、鏡状態における暗表示部領域から光の漏れを大幅に低減することができる。

【０１３３】尚、上記実施例では吸収型偏光選択部材５００として第２の直線偏光成分は透過し、これと偏光軸が直交する第１の直線偏光成分は吸収する場合を示したが、吸収型偏光選択部材５００として第１の直線偏光成分は透過し、第２の直線偏光成分は吸収するものを用いるようにしてもよい。この場合は、透過偏光軸可変部４００が液晶層４０７に電圧を印加しない状態、すなわちオフ状態で鏡状態となり、透過偏光軸可変部４００が液晶層４０７に電圧を印加する状態、すなわちオン状態で画像表示状態となるようにする。すなわち、表示装置全体の電力が切れている場合に鏡状態とすることができる。このことは本表示装置をハンドヘルドＰＣや、携帯電話といったできるだけ消費電力を小さくしたい機器に採用する場合、鏡機能を消費電力がない状態で実現できるためとても有利となる。

【０１３４】尚、本実施例１の表示装置において、構成部材の界面における光の反射を低減するため、各部材を屈折率を合せた透明な粘着剤により光学的に結合する構成にすることも可能である。

【０１３５】（実施例２）本発明の実施例２の、鏡状態への切り替え機能付き表示装置を図１５，図１６を用いて説明する。本実施例２の表示装置は、基本構成が第２の実施の形態の図１、図２に示した表示装置と同様である。すなわち、本実施例２の表示装置は、実施例１で説明した表示装置の吸収型偏光選択部材５００を、反射型偏光選択部材３０１と可変偏光選択部材６００の組み合わせに置き換えたものである。従って、実施例１と同一部分には同じ符号を付け、その部分の詳細な説明は省略する。

【０１３６】本表示装置の構成は、図１５，図１６に示したように、実施例１の表示装置の吸収型偏光選択部材５００に代えて、第１の直線偏光成分は反射し、第２の直線偏光成分は透過する反射型偏光選択部材３０１と、入射した光のうち第１の直線偏光成分は吸収し、第２の直線偏光成分は透過する状態と、全偏光成分を透過する状態のいずれかの状態に選択可能な可変偏光選択部材６００とを、透過偏光軸可変部４００側から順に配置したものである。

【０１３７】尚、観察者は可変偏光選択部材６００側（図中左側）から本表示装置を観察することになる。

【０１３８】画像表示部１０００としては光の透過光量を調節することで画像を表示する液晶表示パネル２００とその背面に配置した照明装置１００とから構成されるものを用いることができきる。

【０１３９】本実施例２では、以下図１６を参照して、（実施例１）と同様、照明装置１００としてはエッジライト方式、表示パネル２００としてはＴＮ液晶表示パネルを用いる場合を説明するが本発明はこれに限定されるものではない。

【０１４０】反射型偏光選択部材３００、及び反射型偏光選択部材３０１は、所定の直線偏光成分は透過し、これと直交する偏光軸を有する直線偏光成分は鏡面反射するものである。このような部材としては（実施例１）で述べた複屈折反射型偏光フィルム、或いは、コレステリック液晶層とその表と裏に１／４波長板を積層した部材を用いることができる。

【０１４１】尚、反射型偏光選択部材３００、及び反射型偏光選択部材３０１として、屈折反射型偏光フィルム、もしくはフィルム状のコレステリック液晶層と１／４波長板の積層部材といったフィルム状の部材を用いる場合は、以下のようにする。すなわちフィルム状の反射型偏光選択部材はそのままでは平坦性が低いため、透明な粘着剤を介して、ガラス板あるいはプラスチック板等の剛性が高く平坦で、なおかつ透明で光学的に等方な透明基材に粘着固定し、歪みがないようにすることが望ましい。フィルム状の反射型偏光選択部材３００、及び反射型偏光選択部材３０１を、液晶表示パネル２００の透明基板等の隣接する他の部材の基板等に粘着固定するようにしてもよい。

【０１４２】透過偏光軸可変部４００は、入射した直線偏光光が透過する際にその偏光軸を変化させて入射した直線偏光光とは偏光軸が直交する直線偏光光へ変化させる状態と、偏光軸を変化させない状態のいずれかの状態に選択可能な部であり、（実施例１）で説明した液晶素子を用いることができる。

【０１４３】本実施例では、透過偏光軸可変部４００は反射型偏光選択部材３００と反射型偏光選択部材３０１との間に配置される。反射型偏光選択部材３００と反射型偏光選択部材３０１は、本表示装置を鏡状態としたときに反射面として機能する部材である。このため、反射型偏光選択部材３００及び反射型偏光選択部材３０１の間隔が大きくなると反射型偏光選択部材３００及び反射型偏光選択部材３０１でそれぞれ反射した像に視差が生じるため、両者の間隔はできるだけ小さくすることが望ましい。つまり、反射型偏光選択部材３００及び反射型偏光選択部材３０１の間に配置される透過偏光軸可変部４００の厚さはできるだけ薄くすることが望ましい。

【０１４４】本実施例２の表示装置は、鏡状態では人が自分の顔を写して観察することを主な用途とする。成人男子の全顔高さの平均が２３４．６ｍｍ（人間工学基準数値数式便覧；１９９２年、技報堂出版）であることから、眼から顔の端までの垂直距離をその半分の１１７．３ｍｍと仮定し、鏡状態の本表示装置と眼の距離を３００ｍｍとし、さらに「平均的な視力１．０の解像力の定義が視角で最小１分」（視力の定義；１９０９年国際眼科学会）であることを考慮すると、視差を感じさせないためには反射型偏光選択部材３００と反射型偏光選択部材３０１の間隔は幾何学的計算から０．１１mm以下とすることが望ましい。

【０１４５】つまり、現在、一般に液晶素子に使用されている厚さ０．７ｍｍのガラス基板を透過偏光軸可変部４００の透明基板４０１、４０２に採用すると本表示装置が鏡状態のとき反射した像には視差を生じることになる。従って、実用上視差の無い鏡を実現するためには透明基板４０１、４０２として０．０５ｍｍ以下の透明基板を用いることが望ましい。このような透明基板４０１、４０２としては、ガラス或いは高分子フィルムを用いることができる。高分子フィルムとしては、特に光学的異方性がないものとしてトリアセチルセルロースや、キャスティング法（溶液流延法）により成膜した無延伸のポリカーボネート等を用いることができる。

【０１４６】或いは、反射型偏光選択部材３００及び反射型偏光選択部材３０１を透明基板４０１、４０２よりも液晶層４０７側に配置し、液晶層４０７を挟むように構成すれば反射型偏光選択部材３００と反射型偏光選択部材３０１との間隔は液晶層の厚み程度になるため、視差のない鏡状態を実現できる。

【０１４７】尚、用途によっては多少の視差は許容されるので、本発明は反射型偏光選択部材３００と反射型偏光選択部材３０１の間隔が上記の値でない場合を除外するものではない。

【０１４８】一方、可変偏光選択部材６００は、入射した光のうち第１の直線偏光成分は吸収し、これと偏光軸が直交する第２の直線偏光成分は透過する状態と、全偏光成分が透過する状態のいずれかの状態を選択可能な部材である。このような部としてはゲストホスト型の液晶素子を用いることができる。ここで、ゲストホスト型液晶素子を用いた可変偏光選択部材６００について図１７，１８を参照して説明する。

【０１４９】ゲストホスト型液晶素子を用いた可変偏光選択部材６００は、ＩＴＯからなる透明電極６０３およびポリイミド系高分子からなる配向膜６０４が全面的に積層形成された第１の透明基板６０１と、透明電極６０６および配向膜６０５が全面的に積層形成された第２の透明基板６０２と、これらに挟まれたゲストホスト型の液晶層６０７とを含む。

【０１５０】尚、２枚の透明基板６０１，６０２にそれぞれ形成された透明電極６０３、６０６は配線及び切り替えスイッチ６００ａを介して電源に接続されており、透明電極６０３、６０６に電圧を印加しない状態と、電圧を印加する状態のいずれかの状態を選択できる。つまり、透明電極６０３，６０６に電位差がなく、液晶層６０７に電界が印加されない状態と、透明電極６０３，６０６に電圧を印加し、液晶層４０７に電界が印加される状態のいずれかの状態を選択可能に構成されている。

【０１５１】液晶層６０７は、２枚の透明基板６０１，６０２を配向膜形成面が向かい合うように配置し、さらに図示しないスペーサーを挟んで、２枚の透明基板６０１、６０２の間に一定の間隙を設け、この間隙の周囲を

シール材６１０で枠状にシールして空間を形成し、この空間にゲストホスト型の液晶を封入することで構成する。

【０１５２】ここで、可変偏光選択部材６００の動作について図１７、図１８を参照して説明する。図１７、及び図１８は可変偏光選択部材６００の一例を示す一部概略断面図である。ゲストホスト型の液晶層６０７はネマチック液晶６０７２にゲストとして２色性色素６０７１を添加したものである。本実施例ではネマチック液晶として誘電異方性が正の液晶を用い、液晶分子長軸の配向方向はラビング処理を施した配向膜６０４、６０５によって、基板６０１，６０２に対して略水平で、なおかつ２枚の透明基板６０１、６０２間で捩じれのない配向、即ちホモジニアス配向とする。このとき２枚の透明基板６０１、６０２近傍の配向方向が互いに平行となるようなプレチルトを付けておく。プレチルトの角度はリバースチルトが起こらないよう２°以上付けることが望ましく、ここでは約４°のプレチルトを付けた。

【０１５３】ここで、２色性色素６０７１は棒状構造をしており、液晶分子に平行な方向に配向する性質がある。このため、例えば液晶分子の配向を基板に対して水平方向から垂直方向へ変化させると、２色性色素もこれに習って水平方向から垂直方向へ配向が変化する。ここでは液晶層６０７として三菱化成株式会社製のゲストホスト液晶材料ＬＡ１２１／４（商品名）を用い、液晶層６０７の厚さは５μｍとした。

【０１５４】図１７は、２枚の透明基板６０１、６０２にそれぞれ形成した透明電極６０３、６０６の間に電位差がなく液晶層６０７に電界が印加されていない状態、すなわち切り替えスイッチ６００ａがオフ状態を示す。この場合、液晶層６０７のネマチック液晶６０７２は初期配向状態、即ち基板に略水平（図中紙面の左右方向）なホモジニアス配向であり、２色性色素６０７１もこれに習って配向している。２色性色素６０７１は分子軸に略平行な吸収偏光軸を持っており、分子軸に平行な偏光成分は強く吸収し、これと直交する偏光成分は殆ど吸収しないという性質を持っている。このため透明基板面に対してほぼ垂直方向から入射するさまざまな偏波面をもつ入射光５０００は液晶層６０７を通過する際、２色性色素６０７１の分子軸に平行な電気ベクトルの振動方向を有する直線偏光成分Ｌｐは吸収され、これと直交する直線偏光成分Ｌｓは透過する。

【０１５５】図１８は２枚の透明基板６０１、６０２にそれぞれ形成した透明電極６０３、６０６に電圧を印加し、液晶層６０７に電界を印加した状態、すなわち切り替えスイッチ６００ａがオン状態を示す。この場合、ネマチック液晶６０７２の分子長軸の配向方向は２枚の透明基板６０１、６０２に対して水平方向から垂直方向へ変化し、これに伴い２色性色素６０７１の配向方向も垂直方向へ変化する。このため透明基板面に対してほぼ垂直方向から入射するさまざまな偏波面をもつ入射光５０００は殆どの偏光成分が吸収されることなく透過する。この際、本実施例では透明基板６０１、６０２の透明電極６０３、６０６に印加した電圧は±３０Ｖ、６０Ｈｚとした。

【０１５６】従って、液晶分子の配向方向を第１の直線偏光の偏光軸と一致させれば、入射した光のうち第１の直線偏光成分は吸収してこれと偏光軸が直交する第２の直線偏光成分は透過する状態と、全偏光成分が透過する状態のいずれかの状態を選択可能な可変偏光選択部材を実現できる。

【０１５７】尚、可変偏光選択部材６００には、外光の映り込みによる画質の劣化を抑えるために、その表面に正反射を抑える処理を施すことが望ましい。但し、ここで重要なのは本発明の表示装置は鏡としても機能するため、可変偏光選択部材６００の正反射防止の処理として、表面に微細な凹凸を形成する、或いは表面に透明微粒子を含有する透明樹脂層を形成するなどして正反射成分を低減する方法は望ましくない。なぜなら、このような処理をした場合、映り込みの低減により画像表示性能は向上するが、鏡に映る像がぼけてしまい鏡の性能が劣化するという問題が生じるからである。従って、可変偏光選択部材６００の正反射防止の処理としてはその表面に反射防止膜を形成することが望ましい。反射防止膜としては公知の技術を用いることができる。即ち、光学設計された屈折率の異なる数種の金属酸化物を蒸着により多層コートする方法、或いはフッ素化合物などの低屈折率材料を塗布する方法を用いることができる。

【０１５８】図１９は本実施例の各部材の軸の方向の説明図である。尚、各軸の角度の表示は画像表示面水平方向の３時の位置を基準とし、ここから逆時計周りの角度で示している。図１９に示す通り、画像表示部１０００を構成するＴＮ液晶表示パネル２００の吸収型偏光選択部材（偏光板）２０８の直線偏光の透過偏光軸は１３５°とする。従って、反射型偏光選択部材３００の直線偏光の透過偏光軸も同じく１３５°、透過偏光軸可変部４００の透明基板４０２側と、透明基板４０１側の液晶分子長軸の配向方向はそれぞれ１３５°と４５°、反射型偏光選択部材３０１の直線偏光の透過偏光軸は４５°、可変偏光選択部材６００の透明基板６０２側と透明基板６０１側の液晶分子長軸の配向方向は共に１３５°とする。

【０１５９】次に、実施例２の表示装置の動作を図面を参照して説明する。図２０及び図２１は本表示装置の基本構成と動作を説明するための概略構成図である。

【０１６０】本実施例では可変偏光選択部材６００が、オフ状態で第１の直線偏光成分（図中紙面上下方向）は吸収し、これと偏光軸が直交する第２の直線偏光成分（図中紙面垂直方向）は透過し、オン状態で全偏光成分を透過する場合を述べる。

【０１６１】また、透過偏光軸可変部４００としては、オフ状態では入射した直線偏光光が透過する際にその偏光軸を変化させて入射した直線偏光光とは偏光軸が直交する直線偏光光へ変化させ、オン状態では偏光軸を変化させない場合を述べる。

【０１６２】図２０は、画像表示状態の場合を示す。本表示装置が画像表示状態の場合は透過偏光軸可変部４００はこれを構成する液晶層４０７に電圧を印加しない状態、すなわちオフ状態とする。また、可変偏光選択部材６００もオフ状態とする。

【０１６３】既に述べた通り、画像表示部１０００は液晶表示パネル２００とのその背面に配置した照明装置１００から構成されており、照明装置１００から出射し、液晶表示パネル２００の吸収型偏光選択部材（偏光板）２０８を透過した第１の直線偏光が画像光３００１として画像表示部１０００から出射する。画像表示部１０００から出射した第１の直線偏光光からなる画像光３００１は反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。

【０１６４】透過偏光軸可変部４００を通過する画像光３００１は第１の直線偏光光から第２の直線偏光光に変化する。透過偏光軸可変部４００を透過した画像光３００１は反射型偏光選択部材３０１へ入射する。反射型偏光選択部材３０１は、第１の直線偏光成分は鏡面反射するが、第２の直線偏光成分は透過するため、透過偏光軸可変部４００により第２の直線偏光光に変化した画像光３００１は、反射型偏光選択部材３０１を透過して、可変偏光選択部材６００に入射する。本表示装置が画像表示状態の場合、可変偏光選択部材６００はオフ状態であり、これに入射する光のうち第１の直線偏光成分は吸収されるが、第２の直線偏光成分は透過する。従って、画像光３００１は可変偏光選択部材６００を透過して、観察者に観察される。

【０１６５】一方、観察者側（図中左側）から表示装置へ向かう外光３００２は非偏光であるが、表示装置が画像表示状態の場合、可変偏光選択部材６００はオフ状態であり、これに入射する光は第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。可変偏光選択部材６００を透過した外光３００２は反射型偏光選択部材３０１を透過し、透過偏光軸可変部４００を透過する際、第２の直線偏光光から第１の直線偏光光に変化して、反射型偏光選択部材３００も透過して、画像表示部１０００に向いほとんど観察者側へは戻ってこない。

【０１６６】従って、画像表示状態では、画像表示部１０００から出射した画像光３００１はほとんど損失することなく観察者へ向かうため明るい画像を得ることができる。さらに、外光３００２は表示装置ではほとんど反射されないので映り込みや、コントラスト比の低下といった外光に起因した画質の劣化が起こらない。

【０１６７】図２１は本表示装置が鏡状態の場合を示す。本表示装置が鏡状態の場合、透過偏光軸可変部４００はこれを構成する液晶層４０７に電圧を印加してオン状態とする。可変偏光選択部材６００もオン状態とする。

【０１６８】この場合も画像表示部１０００から出射し、反射型偏光選択部材３００を透過した明表示に対応する画像光３００１は透過偏光軸可変部４００に入射する。このとき透過偏光軸可変部４００を透過する画像光３００１は偏光軸が変化することなく第１の直線偏光光のまま透過し、反射型偏光選択部材３０１で反射して画像表示部１０００へ戻るため、観察者には観察されない。

【０１６９】一方、観察者側から表示装置へ向かう外光３００２は、表示装置が鏡状態の場合、可変偏光選択部材６００はオン状態であり、ほとんどの偏光成分に対して透明な状態となるので、外光３００２はそのほとんどが可変偏光選択部材６００を透過する。可変偏光選択部材６００を透過した外光３００２は反射型偏光選択部材３０１に入射する。反射型偏光選択部材３０１に入射した外光３００２のうち、第２の直線偏光成分は、反射型偏光選択部材３０１を透過し、第１の直線偏光成分は、反射型偏光選択部材３０１で反射され、再び可変偏光選択部材６００を透過て観察者側へ向かう。一方、反射型偏光選択部材３０１に入射した外光３００２のうち、反射型偏光選択部材３０１を透過した第２の直線偏光成分は偏光軸が変化することなく透過偏光軸可変部４００を透過し、反射型偏光選択部材３００で反射され、再び透過偏光軸可変部４００と、反射型偏光選択部材３０１と可変偏光選択部材６００を透過して観察者側へ向う。

【０１７０】つまり、鏡状態の場合、画像光３００１は反射型偏光選択部材３０１で反射し、画像表示部１０００へ戻るため観察者に観察されない。また、外光３００２は、第１の反射型偏光選択部材３００、及び反射型偏光選択部材３０１により、そのほとんどの偏光成分が反射されるため、極めて明るい鏡として機能する。

【０１７１】尚、上述の実施例１と同様、本実施例においても表示装置を鏡状態にする場合は、画像表示部１０００の該当部分を暗表示にする、或いは画像表示部材を構成する照明装置１００を消灯するといったことを上記動作と連動して行う構成にすることができる。この場合、画像表示部１０００から画像光は出力されないので観察者に不要な迷光が向かって鏡の性能を損なうことがなくなり、特に照明装置１００を消灯する場合は、鏡状態において消費電力を低減できるといった効果もある。

【０１７２】上記の通り、本実施例の表示装置では、反射型偏光選択部材３００及び反射型偏光選択部材３０１は、可変偏光選択部材６００による偏光光の吸収の制御と、透過偏光軸可変部４００による偏光状態の制御により、実効的に透明な状態と、鏡として機能する状態とに切り換えられる。従って、画像表示状態では反射型偏光

選択部材３００及び反射型偏光選択部材３０１を実効的に透明な状態とすることで明るい画像が得られ、さらに周囲が明るい環境であっても、外光は表示装置でほとんど反射されないので、ハーフミラーを使用する場合のような映り込みや、それに伴うコントラスト比の低下といった画質の劣化が生じない。つまり、画像表示状態と鏡状態の切り換えを互いの性能を劣化することなく実現できる。

【０１７３】特に本実施例では、表示装置が鏡状態の場合、可変偏光選択部材６００は透明状態となり、さらに反射型偏光選択部材３０１と反射型偏光選択部材３００によって、外光はそのほとんどの偏光成分が反射されるため、実施例１の表示装置の２倍以上の極めて明るい鏡を実現できるという効果がある。

【０１７４】尚、本表示装置を構成する各部材の界面反射を低減するため、各部材を屈折率を合せた透明な粘着剤により光学的に結合する構成にすることも可能である。

【０１７５】尚、上記実施例では可変偏光選択部材６００の液晶層６０７として、ネマチック液晶に誘電異方性が正の液晶を用いホモジニアス配向としていたが、液晶層６０７のネマチック液晶として誘電異方性が負の液晶を用い、初期状態（電界無印加状態）において液晶分子長軸の方向が透明基板に対して略垂直となるホメオトロピック配向としたものを用いることもできる。この場合、２枚の透明基板６０１、６０２の透明電極６０３、６０６に電圧を印加し、液晶層６０７に電界を印加した際、液晶分子長軸の配向方向は２枚の透明基板６０１、６０２に対して垂直方向から水平方向に変化するが、液晶分子が一定方向に配向するように、液晶の初期配向状態にわずかなプレチルト角を付けておくと良い。

【０１７６】液晶層６０７のネマチック液晶として誘電異方性が負の液晶を用い、ホメオトロピック配向とした場合、２枚の透明基板６０１、６０２の透明電極６０３、６０６の間で電位差がなく液晶層６０７に電界が印加されていない状態、すなわちオフ状態では、液晶層６０７のネマチック液晶はその分子長軸の方向が透明基板に対して略垂直となっており、２色性色素もこれに習って配向しているため、外部からの入射光は液晶層６０７で殆ど吸収されることなく透過する。

【０１７７】一方、２枚の透明基板６０１、６０２の透明電極６０３、６０６に電圧を印加し、液晶層６０７に電界を印加した状態、すなわちオン状態ではネマチック液晶の分子長軸の配向方向は２枚の透明基板６０１、６０２に対して垂直方向から水平方向へ変化し、これに伴い２色性色素の配向方向も水平方向へ変化する。２色性色素は分子軸に略平行な吸収偏光軸を持っており、分子軸に平行な偏光成分は強く吸収し、これと直交する偏光成分は殆ど吸収しないという性質を持っている。このため外部からの入射光は液晶層６０７を通過する際、２色性色素の分子軸に平行な方向に電気ベクトルの振動方向を有する直線偏光成分は吸収され、これと直交する直線偏光成分は透過する。

【０１７８】つまり、液晶層６０７に電界を印加した状態の液晶の配向方向を第１の直線偏光の偏光軸と一致させれば、入射した光のうち第１の直線偏光成分は吸収し、第２の直線偏光成分は透過する状態と、全偏光成分が透過する状態のいずれかの状態を選択可能な可変偏光選択部材を実現できる。

【０１７９】尚、本実施例２では、反射型偏光選択部材３０１の観察者側に可変偏光選択部材６００を配置する場合を述べた。可変偏光選択部材は画像表示状態では反射型偏光選択部材３０１での外光の不要反射を抑制し、鏡状態では実効的に透明な状態となって鏡の明るさ向上に貢献する重要な部材である。しかし、本発明は様々な用途を考慮した場合、反射型偏光選択部材３０１の観察者側に可変偏光選択部材６００を配置しない構成を除外するものではない。この場合、画像表示状態では、外光が反射型偏光選択部材３０１で反射して画像が見にくくなる場合があるが、鏡状態においては反射型偏光選択部材、及び反射型偏光選択部材３０１での外光の反射を阻害する部材がないため８０％以上の極めて高い反射率が得られた。この反射率はアルミニウムの薄膜をガラス基板上に形成した鏡に匹敵する明るさであり、一般の鏡と同等の明るさの鏡が実現できる。

【０１８０】（鏡領域の大きさ）ここで、実施例１および実施例２の表示装置が、鏡状態の際に、観察者が自分の顔を映し観察することが主たる用途である場合、望ましい鏡領域のサイズを求める。成人男子の全顔高さの平均が２３４．６mm、頭幅の平均が幅１５６．４mm（人間工学基準数値数式便覧；１９９２年、技報堂出版）であることを考慮すると、観察者が観察位置を変えることなく顔全体を鏡に映すには鏡の大きさとして高さ１１７．３mm、幅７８．２mm以上の大きさが必要である。

【０１８１】本発明の表示装置は（実施例１）においては、透過偏光軸可変部４００により、また、（実施例２）では透過偏光軸可変部４００と可変偏光選択部材６００により画像表示状態と鏡状態の切り換えを行っている。よって、上記大きさの鏡領域を実現するためには、透過偏光軸可変部４００を構成する２枚の透明基板４０１，４０２にそれぞれ形成された透明電極４０３，４０６と、可変偏光選択部材６００の２枚の透明基板６０１、６０２にそれぞれ形成された透明電極６０３、６０６は少なくとも高さ１１７．３mm、幅７８．２mm以上の領域に対して欠けることなく連続的に形成されていることが望ましい。というのは、透明電極が例えばこの領域範囲内で分割形成されているとすると、透明電極のある部分は鏡として機能するが、透明電極の隙間が鏡として機能せず、この間隙が筋状に観察されるなどして、

鏡としては満足な性能が得られなくなるためである。

【0182】尚、実施例1および実施例2の表示装置を、携帯電話や携帯情報端末といった携帯機器に使用する場合は、表示装置の大きさ自体が、上記した鏡サイズの高さ117．3mm、幅78．2mmに満たない場合がある。そこで、顔全体を映すのではなく、部分的に化粧を直す、或いは目の中のコンタクトレンズを確認する等に使用するのに適した大きさの、鏡のサイズが得られるようにすることもできる。この場合、鏡に顔の4分の1が映る大きさにすれば良い。具体的には鏡の大きさとして高さ58．6mm、幅39．1mm以上にすることが望ましい。

【0183】従って、透過偏光軸可変部400を構成する2枚の透明基板401，402に、それぞれ形成された透明電極403，406と、可変偏光選択部材600の2枚の透明基板601、602にそれぞれ形成された透明電極603、606は、少なくとも高さ58．6mm、幅39．1mm以上の領域に対して欠けることなく連続的に形成されていることが望ましい。

【0184】（実施例3）上述した実施例1及び実施例2の表示装置では、第1の直線偏光を画像光として出射する画像表示部1000として、裏面に照明装置を配置した液晶表示パネルを用いる構成であったが、本発明はこれに限定されるものではない。

【0185】直線偏光光を画像光として出射する画像表示部1000としては、他に2次元光学スイッチ素子として液晶表示パネルを用いた背面投射型表示装置を用いることができる。実施例3は、実施例1で説明した表示装置の画像表示部1000として、背面投射型表示装置を用いたものであり、実施例1と同一部には同じ符号を付け詳細な説明は省略する。

【0186】本表示装置は、図22のように、透過型スクリーン703と、投射装置701と、ミラー702とから構成され、投射装置701から出射した投射光704がミラー702を介して透過型スクリーン703に照射される構造になっている。透過型スクリーン703は、実施例1の反射型偏光選択部材300と、透過偏光軸可変部400と、吸収型偏光選択部材500とを含む。

【0187】投射装置701は、2次元光学スイッチ素子として液晶表示パネルを用いた液晶投射装置を用いることができる。投射装置701は、投射光として各色光の偏光状態が一致した直線偏光を出射するものを用いる。さらに、投射装置701から出射される画像光704は、ミラー702の反射面に対してｓ偏光光、或いはｐ偏光光となるよう構成する。これは一般に、反射面に入射する光は反射面に対してｓ偏光成分とｐ偏光成分とで位相差が生じるため、反射面に対してｓ偏光光、或いはｐ偏光光以外の偏光光が入射するとその偏光状態が変化してしまうからである。

【0188】ミラー702は、光学的に等方な透明ガラスに銀またはアルミニウムのような反射性金属を蒸着したものを用いることができる。

【0189】透過型スクリーン703は、図23に示す通り、フレネルレンズシート1402と、レンチキュラレンズシート1401と、反射型偏光選択部材300と、透過偏光軸可変部400と、吸収型偏光選択部材500とをこの順に配置した構成となっている。フレネルレンズシート1402は凸レンズと同じ作用をする光学部品であり、投射装置701からの主光線の方向を観察者側に曲げて適視範囲を広げる働きをする。レンチキュラレンズシート1401は投射装置701からの限られた投射光束を観察者の観察範囲に有効に配光する作用をする。これにより、明るい画像を得られる。

【0190】図24及び図25に、本実施例で用いることのできるレンチキュラレンズシート1401の一例を説明する。レンチキュラレンズシート1401は、シリンドリカルレンズ状のレンズ1501を一方向に複数配列し、光の集光部以外の部分にブラックストライプ1502を設けた構成となっており、レンズ1501の焦点位置を観察面とすることで、理想的には投射光の損失なく、外光に対するコントラスト比の低下を抑制することができる構成となっている。一般にレンチキュラレンズシートは、その母線を表示面に対して垂直方向になるように配列することで、水平方向に広い視野角が得られる。

【0191】尚、フレネルレンズシート1402とレンチキュラーレンズシート1401はともに、投射装置701からの投射光704の偏光の乱れが極力小さくなるように、複屈折性が小さい部材、例えばアクリル樹脂を用いた射出成形品を用いることが望ましい。

【0192】反射型偏光選択部材300は、すでに述べた通り、鏡の反射面として機能する重要な部材であるため、歪むことがないよう剛性があり平坦で光学的に等方な透明な基板、例えば厚さ3mm程度の射出成形したアクリル樹脂板等に粘着剤により貼りあわせた構成にすることができる。

【0193】反射型偏光選択部材300、透過偏光軸可変部400、吸収型偏光選択部材500の各軸の方向は、投射装置701から出射し、透過型スクリーン703に入射する投射光704を第1の直線偏光として、実施例1で述べた通りに作用するように配置する。

【0194】次に本表示装置の動作を説明する。ここでは吸収型偏光選択部材500が、第1の直線偏光成分は吸収し、第2の直線偏光成分は透過する場合を説明する。

【0195】本表示装置は、画像表示部材に背面投射型表示装置を用いたこと以外は、実施例1と同様の部材で構成しているので、動作も同様となる。即ち、本表示装置が画像表示状態の場合、投射装置701から出射した

画像光７０４はミラー７０２で反射して、透過型スクリーン７０３に入射する。透過型スクリーン７０３に入射した画像光７０４はフレネルレンズ１４０２と、レンチキュラレンズ１４０１の作用により、観察者の観察範囲に有効に広がりながら反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。本表示装置が画像表示状態の場合、透過偏光軸可変部４００を通過する画像光７０４は第１の直線偏光光から第２の直線偏光光に変化し、吸収型偏光選択部材５００を透過して観察者に観察される。

【０１９６】一方、観察者側から本表示装置へ向かう外光は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。吸収型偏光選択部材５００を透過した外光は透過偏光軸可変部４００を透過する際、第２の直線偏光光から第１の直線偏光光に変化し、反射型偏光選択部材３００を透過して、フレネルレンズ１４０２と、レンチキュラレンズ１４０１、さらにはミラー７０２を介して投射装置７０１へ向かい観察者側へはほとんど戻ってこない。

【０１９７】従って、画像表示状態では、投射装置７０１から出射し、フレネルレンズ１４０２と、レンチキュラレンズ１４０１を通過した画像光７０４はほとんど損失することなく観察者へ向かうため明るい画像を得ることができる。さらに、外光は表示装置でほとんど反射されないので映り込みやコントラスト比の低下といった外光に起因した画質の劣化が起こらない。

【０１９８】本表示装置が鏡状態の場合は、投射装置７０１から出射した画像光７０４はミラー７０２を介して、透過型スクリーン７０３に入射する。透過型スクリーン７０３に入射した画像光７０４はフレネルレンズ１４０２と、レンチキュラレンズ１４０１の作用により、観察者の観察範囲に有効に広がりながら反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。表示装置が鏡状態の場合、透過偏光軸可変部４００を透過する画像光７０４は偏光軸が変化することなく第１の直線偏光光のまま透過し、吸収型偏光選択部材５００で吸収されるため、観察者には観察されない。

【０１９９】一方、観察者側から表示装置へ向かう外光は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過して透過偏光軸可変部４００に入射する。透過偏光軸可変部４００に入射した外光は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光光のまま透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００は第１の直線偏光成分は透過し、第２の直線偏光成分は鏡面反射するため、外光は反射型偏光選択部材３００で反射する。反射型偏光選択部材３００で反射した外光は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光光のまま透過し、偏光選択部材５００も透過して観察者へ向かう。

【０２００】従って、鏡状態では画像光７０４は吸収型偏光選択部材５００で吸収され、観察者に至ることがなく、表示装置に入射する外光は理想的には非偏光の半分の光が反射型偏光選択部材３００で反射して、観察者側に向かうため明るい鏡として機能する。

【０２０１】尚、本表示装置を鏡状態にする場合は、鏡状態となる領域に該当する領域では投射装置７０１の画像を暗表示にする。この場合、投射装置７０１からの画像光はほとんど漏れないので観察者に不要な光が向かうことがないのでコントラスト比が高い反射像が得られる鏡状態が実現できるといった効果がある。

【０２０２】また、上記説明では吸収型偏光選択部材５００が第２の直線偏光成分は透過し、第１の直線偏光成分は吸収する場合を示したが、吸収型偏光選択部材５００が第１の直線偏光成分は透過し、第２の直線偏光成分は吸収するものを使用してもよい。この場合は表示装置の消費電力が０の場合に、鏡として機能させることができる。

【０２０３】また、本実施例では透過型スクリーン７０３を、図２３に示す通り、フレネルレンズシート１４０２と、レンチキュラレンズシート１４０１と、反射型偏光選択部材３００と、透過偏光軸可変部４００と、吸収型偏光選択部材５００とをこの順に配置した構成とした。しかし、この構成とは別に、図２６に示す通り、透過型スクリーン７０３をフレネルレンズシート１４０２と、レンチキュラレンズシート１４０１と、反射型偏光選択部材３００と、透過偏光軸可変部４００と、反射型偏光選択部材３０１と、可変偏光選択部材６００とをこの順に配置した構成としてもよい。この場合は、実施例２で説明した表示装置の画像表示部１０００に、背面投射型表示装置を用いたこととなり、実施例２での説明と同様な動作、作用が得られる。

【０２０４】また、本実施例の透過型スクリーン７０３を構成する鏡機能部（反射型偏光選択部材３００と透過偏光軸可変部４００と反射型偏光選択部材３０１と可変偏光選択部材６００）と光学系（フレネルレンズシート１４０２とレンチキュラレンズシート１４０１）のうち鏡機能部を光学系から着脱可能な構造として、鏡機能が不要なときには鏡機能部を取り外す構成としてもよい。あるいは、画像表示部を含まず鏡機能部を独立して備えたスクリーンを構成し、この鏡機能スクリーンを任意の表示装置に必要に応じて装着する構成とすることも可能である。

【０２０５】（実施例４）本発明の実施例４の表示装置を図２７、図２８を用いて説明する。本実施例４は、実施例２で説明した表示装置の透明基板４０１、４０２（図１６参照）に、導電性の金属線状パターンを千数百オングストロームのピッチで形成し、これら金属線状パターンに、反射型偏光選択部材３０１と透明電極４０

３、及び、反射型偏光選択部材３００と透明電極４０６の機能を兼用させる構成としたものである。従って、上記説明と同一部には同じ符号を付け詳細な説明は省略する。

【０２０６】本実施例４では、透過偏光軸可変手段４００の透明基板４０１、４０２にアルミニウムの金属線状パターンを千数百オングストロームのピッチで形成する。この場合、金属線状パターンに入射する光は、金属線状パターンの線の長手方向と平行な直線偏光成分は反射し、これと直交する方向の直線偏光成分は透過するため、金属線状パターンは反射型偏光選択部材として機能する。また、これらの隣り合う線状パターンの一部を電気的に接続することにより、電位を同一あるいは略同一の状態にすることができるため、特定の直線偏光成分を透過する透明電極としても機能させることができる。つまり、金属線状パターンは反射型偏光選択部材と透明電極の機能を兼用する。尚、隣り合う線状パターン同士の電気的な接続は、反射型偏光選択部材の機能に悪影響を与えないように、周縁部などの鏡領域以外の場所で行うようにする。

【０２０７】ここでは、透過偏光軸可変部４００は、図２７のように、金属線状パターン３１１及びポリイミド系高分子からなる配向膜４０４が全面的に積層形成された第１の透明基板４０１と、同じく金属線状パターン３１０及び配向膜４０５が全面的に積層形成された第２の透明基板４０２と、液晶層４０７とを含む。

【０２０８】２枚の透明基板４０１，４０２にそれぞれ形成された金属線状パターン３１１、３１０は、図示しない配線、及びスイッチング素子を介して電源に接続されており、金属線状パターン３１１、３１０に電圧を印加しない状態と、電圧を印加する状態のいずれかの状態を選択可能に構成されている。つまり、金属線状パターン３１１、３１０に電位差がなく、液晶層４０７に電界が印加されない状態と、金属線状パターン３１１、３１０に電圧を印加し、液晶層４０７に電界が印加される状態のいずれかの状態を選択可能に構成されている。また、金属線状パターン３１０、３１１の線の長手方向はお互いに直交するように構成・配置する。

【０２０９】液晶層４０７は、２枚の透明基板４０１，４０２を配向膜４０４、４１０の形成面が向かい合うように配置し、さらに図示しないスペーサーを挟むことで２枚の透明基板４０１、４０２の間に一定の間隙を設け、この間隙の周囲をシール材４１０で枠状にシールして空間を形成し、この空間に誘電異方性が正のネマチック液晶を封入することで構成する。

【０２１０】図２８は本実施例の各部材の軸の方向の説明図である。尚、各軸の角度の表示は画像表示面水平方向の３時の位置を基準とし、ここから逆時計周りの角度で示している。図２８に示す通り、画像表示部１０００を構成するＴＮ液晶表示パネル２００の吸収型偏光選択部材（偏光板）２０８の直線偏光の透過偏光軸は１３５°とする。従って、反射型偏光選択部材として機能する金属線状パターン３１０の直線偏光の透過偏光軸も同じく１３５°、透過偏光軸可変部４００の透明基板４０２側と、透明基板４０１側の液晶分子長軸の配向方向はそれぞれ１３５°と４５°、反射型偏光選択部材として機能する金属線状パターン３１１の直線偏光の透過偏光軸は４５°、可変偏光選択部材６００の透明基板６０２側、と透明基板６０１側の液晶分子長軸の配向方向は共に１３５°とする。

【０２１１】上記構成により本実施例４の表示装置は、金属線状パターン３１０が実施例２の反射型偏光選択部材３００と電極４０６の機能を果たし、金属線状パターン３１１が実施例２の反射型偏光選択部材３０１と電極４０３の機能を果たすため、本実施例４の表示装置は、実施例２の表示装置と同様に動作し、同じ効果が得られる。

【０２１２】なお、実施例２で述べた通り、反射型偏光選択部材３００，３０１は表示装置を鏡状態としたときに反射面として機能する部材である。このため、反射型偏光選択部材３００と反射型偏光選択部材３０１の間隔が大きくなると反射型偏光選択部材３００と反射型偏光選択部材３０１のそれぞれで反射した像に視差が生じるため、両者の間隔はできるだけ小さくする必要があり、実用的には０．１１ｍｍ以下とすることが望ましい。本実施例４では特に反射型偏光選択部材３００として機能する金属線状パターン３１０と、反射型偏光選択部材３０１として機能する金属線状パターン３１１との間には、数μｍ程度の液晶層４０７と１μｍ未満の配向膜４０４、４１０等の薄膜があるだけなので、両者の間隔は１０μｍにも満たない。このため、明るく視差のない高品位な鏡が実現できるという効果がえられる。

【０２１３】また、金属線状パターン３１０，３１１は、平坦なガラスなどの基板上に形成されるため、温度や湿度などの環境の変化を受けにくく、環境の変化によるゆがみが発生しにくい鏡が実現できるという効果もある。

【０２１４】また、本発明では、金属線状パターン３１０，３１１は、可視光の範囲で均一な反射を得られるものであれば良く、線状パターンの具体的構造やピッチ、パターン高さ等は特に限定されるものではない。また、アルミニウム以外にクロムや銀などで形成した金属線状パターンを用いても良い。

【０２１５】（実施例５）上記実施例１～実施例４では、第１の直線偏光を画像光として出射する画像表示部１０００の上部に、反射型偏光選択部材３００と透過偏光軸可変部４００と偏光選択部材５００からなる鏡機能部、或いは、反射型偏光選択部材３００と透過偏光軸可変部４００と反射型偏光選択部材３０１と可変偏光選択部材６００からなる鏡機能部を配置した場合を説明し

た。これらの場合、画像表示部１０００は、鏡機能部が配置されていなくても画像表示が可能であり、機器の使用目的によっては鏡機能部を着脱式にして、鏡機能が不要な場合に鏡機能部を取り外すなど、利便性を向上することができる。

【０２１６】しかしながら、本発明はこれらに限定されるものではない。つまり、鏡機能部がある場合に画像表示が可能になるような構成、あるいは鏡機能部と画像表示部材の一部構成を共用した構成であっても良い。

【０２１７】図２９を用いて、実施例５の表示装置について説明する。本実施例５は、実施例１との共通部分が多いため（例えば図８参照）、実施例１と同様な部材には同じ符号を付け詳細な説明は省略する。

【０２１８】本表示装置は、実施例１で説明した表示装置において、照明装置１００として赤色、緑色、青色の３原色を時分割に照射可能なものを用い、画像表示部１０００から観察者側の吸収型偏光選択部材（偏光板）２０８を取り除いたものである。従って、反射型偏光選択部材３００と透過偏光軸可変部４００と吸収型偏光選択部材５００からなる鏡機能部を取り除いた場合、本実施例の液晶表示パネル２００は鮮明な画像を表示することができない。

【０２１９】本実施例の液晶表示パネル２００は、実施例１の液晶表示パネル２００において、吸収型偏光選択部材（偏光板）２０８を取り除いたほかに、カラーフィルタを無くし、フィールド順次カラー表示方式に対応できるように液晶の応答が高速化可能なものとした。

【０２２０】フィールド順次カラー表示方式は例えば特開平５－１９２５７号公報、特開平１１－５２３５４号公報などに技術の詳細が記載されている。本方式は３原色の照明光を時分割で液晶表示パネルに照射し、それに同期させて液晶を駆動することによりカラー画像の表示を実現するものである。すなわち、液晶表示パネルは１フレームの表示を行うために、３原色に対応した３つのサブフレームを順次表示する必要があるため液晶がより高速に応答する必要がある。フィールド順次カラー表示方式に対応するように液晶の応答を速くするには、例えばＴＮモードを用いる場合は上記ウェーブガイドの条件を満足するために複屈折Δｎの大きな液晶を用い、液晶層２０７の厚さを２μm程度と薄く構成すれば良い。

【０２２１】尚、本実施例では以下、ＴＮモードの場合を説明するが、フィールド順次カラー表示方式に対応した応答特性が得られる構成であれば、本発明の液晶表示パネルは上記構成に限定されるものではない。

【０２２２】照明装置１００は透明媒体からなる導光体１９３と、導光体１９３の端面に配置した赤色、緑色、青色の３原色の光を出射する光源１９０と、導光体１９３の裏面に配置した偏光維持反射シート１９２と、導光体１９３の前面に配置した偏光維持拡散部１９１とから構成される。

【０２２３】赤色、緑色、青色の３原色の光を出射する光源１９０としては３原色のそれぞれの色光を発光する３つのチップを一体化したＬＥＤ（Light Emitting Diode）を用いることができる。このようなＬＥＤは日亜化学工業株式会社から発売されている。

【０２２４】導光体１９３は、透明なアクリル樹脂から構成され、端面から入射した光を全反射により内部に閉じ込める構成と、内部を伝搬する光の反射角度を変えることで液晶表示パネル２００側へ光を放射する微細な傾斜面を有する多数の凹凸面または段差で構成された傾斜反射面１９４を裏面（液晶表示パネル２００と反対の側の面）に備える。これは後述する理由から液晶表示パネル２００側から導光体１９３に入射する光の偏光状態を維持するためである。

【０２２５】傾斜反射面１９４はアルミニウム、銀等の金属薄膜、或いは誘電体多層膜により鏡面反射面とすることが望ましいが、これらに限定されるものではなく、このような特別な反射部材を付与しなくとも、空気とアクリル樹脂との屈折率の差により必要とされる反射機能が満たされるものとする。

【０２２６】ここでは、傾斜反射面１９４は平均ピッチ２００μm、平均高さ１０μm、平均傾斜角度４１°とした。尚、傾斜反射面１９４の高さを光源１９０に近いところでは低く、光源１９０から遠い場所では高くなるよう連続的に変化させる、或いは傾斜反射面１９４のピッチ、もしくは傾斜角度を光源１９０からの距離により連続的に変化させる、或いは導光体１９３の厚さを光源１９０から離れるに従って薄くなるよう構成するなどして、導光体１９３から出射する光の均一性を高めるようにしても良い。

【０２２７】尚、導光体１９３の形状は液晶表示パネル２００側から導光体１９３に入射する光の偏光状態を略維持するものであれば本形状に限定されるものではい。

【０２２８】偏光維持反射シート１９２はガラス板や樹脂板、樹脂フィルム等の基材上に偏光状態を維持する反射面を形成したものであり、液晶表示パネル２００側から照明装置１００へ戻ってきた光を再びその偏光状態を維持したまま液晶表示パネル２００側へ反射する機能を有する。ここで述べる偏光状態を維持する反射面とは少なくとも垂直入射光に対しては、直線偏光光は同じ直線偏光光のまま反射し、円偏光はその回転方向が逆の円偏光として反射する反射面のことである。具体的には反射面として基材にＡｌ、Ａｇ等の金属薄膜を被着したもの、或いは光源光の波長帯域に対して高い反射率が得られるように構成した誘電体多層膜による鏡面反射面を使用する。

【０２２９】偏光維持拡散部１９１は導光体１９３から出射した光の出射角度分布や面内での輝度分布を均一化するためのものであり、さらにこれを通過する光の偏光状態は略維持するものである。偏光維持拡散部１９１と

しては光学的に等方な透明基材上に複数の球状透明ビーズを面状に密に並べ、透明な樹脂で固定したもの、或いは光学的に等方な透明基材上に形成したホログラム拡散板、或いはSPIE, Vol.1536, Optical Materials Technology for Energy Efficiency and Solar Energy Conversion X (1991), pp138-148に記載のＬＣＧ（light control glass）等を使用することができる。

【０２３０】図３０は本実施例の各部材の軸の方向の説明図である。図示の通り、液晶表示パネル２００として、ＴＮ液晶表示パネルを用いた場合は視角特性の水平方向の対称性を得るため、通常、偏光板２０９の直線偏光の透過偏光軸は４５°もしくは１３５°とする（本実施例では４５°）。透明基板２０２側の液晶配向軸、及び透明基板２０１側の液晶配向軸はそれぞれ４５°と１３５°とし、反射型偏光選択部材３００の直線偏光の透過偏光軸を１３５°、透過偏光軸可変部４００の透明基板４０２側と、透明基板４０１側の液晶分子長軸の配向方向はそれぞれ１３５°と４５°、吸収型偏光選択部材５００の直線偏光の透過偏光軸は４５°とする。

【０２３１】次に本実施例の動作を説明する。光源１９０から出射した光は導光体１９３に入射し、導光体１９３を全反射を繰り返しながら伝播していく。導光体１９３を伝播する光のうち傾斜傾斜面１９４に至った光はその進行方向が変わり、導光体１９３の表面側から出射する。導光体１９３から出射した光は偏光維持拡散部１９１により出射角度分布や、面内での輝度分布が均一化された後、液晶表示素子２００に照射される。

【０２３２】液晶表示パネル２００に照射された光のうち、偏光板２０９を透過した直線偏光光は、液晶層２０７を通過して反射型偏光選択部材３００に入射するが、この際、液晶層２０８を透過する光の偏光状態は液晶層２０７に印加する電圧によって変化させることができる。このため画像情報発生部から伝えられる画像情報に対応した電圧を透明基板２０２、２０１上の透明電極２０３、２０５に印加し、液晶層２０７に電界を印加することで、液晶層２０７を通過する光の偏光状態を変え、反射型偏光選択部材３００を透過する光量を制御することで直線偏光光からなる光学画像を形成することができる。即ち、実施例１において液晶表示パネル２００の観察者側に配置した吸収型偏光選択部材（偏光板）２０８の機能を、本実施例の反射型偏光選択部材３００が兼用することになる。

【０２３３】反射型偏光選択部材３００を透過した画像光は透過偏光軸可変部４００に入射する。本表示装置が画像表示状態の場合、透過偏光軸可変部４００はこれを構成する液晶層４０７に電圧を印加しない状態、すなわちオフ状態とする。

【０２３４】ここで、反射型偏光選択部材３００を透過する直線偏光成分を第１の直線偏光成分とし、これと偏光軸が直交する直線偏光成分を第２の直線偏光成分とすると、透過偏光軸可変部４００を通過する画像光は第１の直線偏光光から第２の直線偏光光に変化する。透過偏光軸可変部４００を透過した画像光は吸収型偏光選択部材５００に入射する。吸収型偏光選択部材５００は第１の直線偏光成分は吸収し、第２の直線偏光成分は透過するため、透過偏光軸可変部４００により第２の直線偏光光に変化した画像光３００１は吸収型偏光選択部材５００を透過して、観察者に観察される。

【０２３５】本表示装置が鏡状態の場合、透過偏光軸可変部４００はこれを構成する液晶層４０７に電界を印加してオン状態とする。このとき本表示装置には上記実施例において吸収型偏光選択部材として設けていた吸収型偏光選択部材（偏光板）２０８がないため、照明装置１００が点灯していると画像光が観察者側に漏れるため反射像のコントラスト比が低下して見やすい鏡が実現できない。従って、照明装置１００は鏡状態の場合には消灯する。本実施例の場合、照明装置１００の光源１９０としてＬＥＤを用いることで高速に点灯、消灯ができるので、鏡状態と画像表示状態は観察者にストレスを感じさせないぐらい高速に切り替えられる。

【０２３６】一方、観察者側から本表示装置へ向かう外光は吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過して透過偏光軸可変部４００に入射する。透過偏光軸可変部４００に入射した外光は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００は第１の直線偏光成分は透過し、第２の直線偏光成分は鏡面反射するため、外光３００２は反射型偏光選択部材３００で反射する。反射型偏光選択部材３００で反射した外光３００２は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、さらに吸収型偏光選択部材５００も透過して観察者へ向かう。

【０２３７】従って、本実施例の表示装置は、鏡状態では照明装置を消灯するため、画像光が観察者に至ることがなく、外光のうち、理想的には非偏光の半分の光が反射型偏光選択部材３００で反射して、観察者側に向かうため明るい鏡として機能する。

【０２３８】この他に本実施例には以下の特有の効果がある。

【０２３９】図３１は本実施例特有の効果を説明するための図である。ここで、反射型偏光選択部材３００を透過する直線偏光成分を第１の直線偏光成分とし、これと偏光軸が直交する直線偏光成分を第２の直線偏光成分とすると、偏光板２０９は第２の直線偏光成分を透過する。

【０２４０】本表示装置では上記の通り、照明装置１００から液晶表示パネル２００に照射された光のうち偏光板２０９を透過した第２の直線偏光光（図中紙面垂直方

向）は、液晶層２０７を通過して反射型偏光選択部材３００に入射する。この際、液晶層２０７を透過する光の偏光状態は画像情報に対応して変調され、明表示領域を通過する光３１００は第２の直線偏光光から第１の直線偏光光に変化して反射型偏光選択部材３００を透過して、観察者へ向かう。

【０２４１】一方、暗表示領域を通過する光３１０１は第２の直線偏光光のまま反射型偏光選択部材３００に入射するため、反射型偏光選択部材３００で反射して観察者には至らない。反射型偏光選択部材３００で反射した光３１０１は再び第２の直線偏光光のまま液晶層２０７及び偏光板２０９を透過して照明装置１００に戻る。この際、照明装置１００を構成する偏光維持拡散部、導光体、及び偏光維持反射シート１９２は液晶表示素子２００側から戻る光の偏光状態を略維持したまま、透過、或いは反射する。このため照明装置１００で反射して液晶表示パネル２００に向かう光３１０１は概ね第２の直線偏光光となっているため偏光板２０９でほとんど吸収されることなく液晶層２０７に入射する。液晶層２０７に入射した光３１０１のうち、明表示領域に入射した光は今度は第２の直線偏光光から第１の直線偏光光に変化して反射型偏光選択部材３００を透過して、観察者へ向かい画像光として有効利用できる。

【０２４２】つまり、暗表示領域に入射した光は、最初は反射型偏光選択部材３００で反射するため画像光とはならない。しかし、反射型偏光選択部材３００で反射した光は照明装置１００に向い、照明装置１００において偏光状態が略維持された状態で反射され、再び液晶表示パネル２００に向かう。このため、大きな損失が無い状態で光の再利用が行われることになり、明表示領域の明るさが向上することになる。

【０２４３】また、一般に、カラーフィルタの光透過率は２５％程度と低いのだが、本実施例ではカラーフィルタを用いないため、より効率良く光の再利用が行われることになる。

【０２４４】ここで、一般に液晶表示パネルでは画面全面を白表示する場合と、一部分を白表示する場合とでは白表示の輝度は変わらない。一方、ＣＲＴ（Cathode Ray Tube）では画面全面を白表示する場合に対して、画面の１５％の部分を白表示する場合には白表示を４倍程度明るくできるといわれている。このことは例えば太陽光など部分的に高輝度な画像の表示を行う場合に、ＣＲＴでは液晶表示パネルよりも迫力ある画像が得られるという画質の差となって現れる。

【０２４５】本実施例の表示装置では暗表示領域に入射した光を再利用することで、明表示領域の明るさを向上することができるため、画面全面を白表示する場合に比べて、一部分を白表示する場合に白表示を明るくすることができる。従って、ＣＲＴに近い迫力ある画像が得られることになる。

【０２４６】さらに、本表示装置を携帯電話などの携帯機器の表示部として用いる場合には以下の効果が得られる。本表示装置は照明装置を点灯する場合はフィールド順次カラー表示方式によるカラー表示装置として機能するが、照明装置を消灯した場合には、カラーフィルタが無いため明るいモノクロ表示の反射型液晶表示パネルとして機能させることができる。ここで、カラー表示の場合には１フレームの表示を行うのに赤色、緑色、青色の少なくとも３つのサブフレームを表示する必要があるが、モノクロ表示の場合はサブフレームを設ける必要がないため駆動周波数を３分の１以下にすることができる。駆動周波数を３分の１以下に下げることができれば消費電力は大幅に低減することができるため、駆動周波数切替部を設けてカラー表示状態と、モノクロ表示状態とで駆動周波数を変えられるようにすると、モノクロ表示状態の消費電力は大幅に低減できる。

【０２４７】つまり本表示装置を携帯機器の表示部として用いた場合、機器が使用状態のときは照明装置を点灯し、カラー表示状態とすることで迫力があり、明るく高品位な画像が得られ、一方、機器が待機時には照明装置を消灯し、駆動周波数を下げ、モノクロ表示状態とすることで消費電力をきわめて低くできる。このため、例えば携帯電話の待受け時間を長くできるなど携帯機器のバッテリーによる使用時間を長くすることができる。

【０２４８】さらにこれらの効果は画像表示状態と鏡状態を互いの性能を劣化することなく切替可能であるうえに成り立つことは上述の通りである。また、本実施例では液晶表示パネルの観察者側の透明基板に金属線状パターンを形成し、各パターン同士の一部を電気的に接続した構造とすることで、該金属線状パターンに透明電極と反射型偏光選択部材の機能を兼用させる構成としても良い。

【０２４９】（実施例６）以下、本発明の他の実施例を図面をもとに説明する。

【０２５０】図３２を用いて、本発明の実施例６の鏡状態への切り替え機能付き表示装置を説明する。本表示装置は、上述した実施例１において、画像表示部１０００として、反射型液晶パネル３０００を用いたものであり、上記実施例と同じ部材には同じ符号をつけ詳細な説明は省略する。

【０２５１】本実施例６の表示装置は、反射型液晶素子３０００を含み、反射型液晶素子は、透明基板３０３０と、反射部を備える反射基板３１００と、これら２枚の基板をビーズ等のスペーサを介して張り合わせ、枠状のシール材によりシールすることにより形成した空間に封止した液晶層３１３０とを有する。また、透明基板３０３０には、位相差板３０２０、反射型偏光選択部材３００、透過偏光軸可変部４００、及び吸収型偏光選択部材５００が重ねて配置されている。

【０２５２】反射基板３１００としては、ガラスや高分

子フィルム等の平坦な絶縁基板をもちい、ここでは厚さ０．７ｍｍのガラス基板を用いた。反射基板３１００には走査電極と信号電極、及びこれらの交差部に備えられた例えばＴＦＴ（Thin FilmTransistor）等からなるスイッチング素子３１１０と、これらの上部に形成した絶縁層３０９０と、絶縁層の上に形成され、絶縁層３０９０に開けられたスルーホール３１２０を介してスイッチング素子と電気的に接続されたマトリクス状に細分化された画素電極３０７０とが備えられる。

【０２５３】画素電極３０７０はアルミニウム、銀といった反射率の高い金属からなり、絶縁層３０９０上に形成された微細な凹部または凸部形状により、拡散反射性の反射部として機能するものである。画素電極３０７０の上層にはポリイミド系高分子からなる配向膜３０６０が全面的に形成され、その表面はラビング法等により表面処理がなされる。

【０２５４】透明基板３０３０としてはガラス、高分子フィルムなどの光学的に等方で平坦な透明絶縁基板を用いることができ、ここでは厚さ０．７ｍｍのガラス基板を用いた。透明基板３０３０には、反射基板３１００の画素電極３０７０に対応する位置にカラーフィルタ３０４０を形成する。カラーフィルタ３０４０はそれぞれ赤色、緑色、青色の３原色に対応した透過スペクトルを有する３種類のカラーフィルタを交互に繰り返し、画素電極３０７０に対応する位置に配置したものである。

【０２５５】また、カラーフィルタ３０４０の画素間に相当する位置にはブラックマトリクスを形成して画素間からの漏れ光を抑えるようにしてもよい。カラーフィルタ３０４０の上層には図示しないオーバーコート層を介してＩＴＯからなる透明電極３０５０を全面的に形成し、さらに透明電極３０５０の上層にポリイミド系高分子からなる配向膜３２１０を全面的に形成して、その表面をラビング法等により表面処理を行っている。

【０２５６】透明基板３０３０と反射基板３１００は、透明電極３０５０形成面、及び反射電極３０７０形成面が対向するよう貼り合せられている。この際、両基板間にビーズスペーサを分散配置し、両基板の表示面相当部分の周囲を枠状のシール材によりシールすることで一定の間隙を有する空間が形成される。

【０２５７】両基板３０３０，３１００の間隙には、誘電異方性が正のネマチック液晶にカイラル剤を少量（０．１～０．２％）添加した液晶組成物を封入、封止して液晶層３１３０を構成した。液晶層３１３０のΔｎｄは０．３６５μｍとした。液晶層３１３０の液晶分子長軸の方向は透明基板３０３０、及び反射基板３１００上に形成された配向膜３２１０、及び配向膜３０６０に行なわれた表面処理（配向処理）によって配向方向が規定され、２枚の基板間で連続的に所定の角度だけねじれた状態となる。

【０２５８】透明基板３０３０には位相差板３０２０が積層される。位相差板３０２０としては例えばポリカーボネート、ポリサルホン、ポリビニルアルコール等の一軸延伸した高分子フィルムを用いることができる。ここでは位相差板３０２０としてΔｎｄが０．１８μｍのポリカーボネートからなる位相差板を用いた。

【０２５９】透明基板３０３０、位相差板３０２０、反射型偏光選択部材３００、透過偏光軸可変部４００、吸収型偏光選択部材５００はそれぞれアクリル系の接着剤により光学的に結合するように接着した。

【０２６０】図３３は、観察者側から見た際の本表示装置の各部材の軸の方向を示す図である。各軸の角度は画像表示面の水平方向３時の位置を基準とし、ここから逆時計周りの角度で示している。図３３に示す通り本表示装置は反射基板３１００側の液晶配向軸を２９５°、透明基板３０３０側の液晶配向軸の方位角を６５°、位相差板３０２０の遅相軸を１３５°、反射型偏光選択部材３００の直線偏光の透過偏光軸を３０°、透明基板４０２側の液晶配向軸を３０°、透明基板４０１側の液晶配向軸を１２０°、吸収型偏光選択部材５００の直線偏光の透過偏光軸を１２０°とした。

【０２６１】次に本表示装置の動作を図面を参照して説明する。尚、本実施例においても上記実施例１等と同様、反射型偏光選択部材３００を透過する直線偏光成分を第１の直線偏光成分をとし、これと偏光軸が直交する直線偏光成分を第２の直線偏光成分とする。

【０２６２】図３４は本表示装置が鏡状態の場合を示す。この場合、観察者側から本表示装置へ向かう外光３００２は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過して透過偏光軸可変部４００に入射する。透過偏光軸可変部４００に入射した外光３００２は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００は第１の直線偏光成分は透過し、第２の直線偏光成分は鏡面反射するため、外光３００２は反射型偏光選択部材３００で反射する。反射型偏光選択部材３００で反射した外光３００２は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、さらに吸収型偏光選択部材５００も透過して観察者へ向かう。

【０２６３】つまり、本表示装置は鏡状態の場合、外光３００２は反射型液晶素子３０００に至ることがなく、反射型偏光選択部材３００で反射して、観察者側に向かい明るい鏡として機能する。

【０２６４】尚、本表示装置を鏡状態にする場合は、反射型液晶素子３０００を非表示状態にして無駄な電力を消費することがないようにすることができる。

【０２６５】図３５、及び図３６は本表示装置が画像表示状態の場合を示す。画像表示状態については図３２も参照しながら説明する。この場合、観察者側（図中左

側）から表示装置へ向かう外光３００２は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。吸収型偏光選択部材５００を透過した外光３００２は透過偏光軸可変部４００を透過する際、第２の直線偏光光から第１の直線偏光光に変化し、反射型偏光選択部材３００を透過して反射型液晶素子３０００に入射する。反射型液晶素子３０００に入射した第１の直線偏光光は位相差板３０２０、液晶層３１３０を通過し、画素電極３０７０で反射して、再び液晶層３１３０、位相差板３０２０を通過して反射型偏光選択部材３００に入射する。この際、液晶層３１３０を透過する光の偏光状態は液晶層３１３０に印加する電圧によって変化する。

【０２６６】ここで、スイッチング素子３１１０は、画素電極３０７０にスルーホール３１２０を介して接続されており、画素電極３０７０に印加する電圧をスイッチングすることで、透明電極３０５０と画素電極３０７０とに挟まれた液晶層３１３０に印加する電圧を画素毎に制御することができる。従って、画像情報に対応した電圧を透明電極３０５０と画素電極３０７０とに印加し、液晶層３１３０に所定の電圧を印加することで、液晶層３１３０を通過する光の偏光状態を制御し、反射型偏光選択部材３００を透過する光量を制御して光学画像を形成することができる。

【０２６７】図３５は明表示の場合を示す。本実施例の構成では、液晶層３１３０に電圧が印加されていないとき、反射型液晶素子３０００に入射した光は第１の直線偏光光のまま反射し、再び反射型偏光選択部材３００を透過して、透過偏光軸可変部４００に入射する。透過偏光軸可変部４００に入射した光はこれを透過する際、第１の直線偏光光から第２の直線偏光光に変化し、吸収型偏光選択部材５００を透過して、観察側へ向かい明表示となる。

【０２６８】図３６は暗表示の場合を示す。本実施例の構成では、液晶層３１３０に所定の電圧を印加すると、反射型液晶素子３０００に入射した第１の直線偏光光は反射型液晶素子３０００で反射し、出射する際、第２の直線偏光光となって、再び反射型偏光選択部材３００に入射する。反射型偏光選択部材３００に再入射した第２の直線偏光光は反射型偏光選択部材３００で反射して再び反射型液晶素子３０００に入射する。反射型液晶素子３０００に入射した第２の直線偏光光は反射型液晶素子３０００で反射し、出射する際、第１の直線偏光光となる。

【０２６９】しかし、この際、反射型液晶素子３０００の透明基板３０３０には赤色、緑色、青色の３原色に対応したそれぞれ異なる透過スペクトルを有する３種類のカラーフィルタ３０４０が交互に繰り返し形成されている。従って、例えば、図示のように最初に反射型液晶素子３０００に入射した光が、緑色のカラーフィルタ３０４０Ｇに入射、透過し、２回目の入射では青色のカラーフィルタ３０４０Ｂに入射することになれば、光はほとんど吸収されて暗表示となる。また、反射型液晶素子３０００に入射した光が同じ色のカラーフィルタを通過するとしても、往路復路を２回で合計４回カラーフィルタを通過することになるので暗い表示が得られる。すなわち、本実施例の構成では暗表示の暗さを向上させるための部材として、カラーフィルタを利用している。

【０２７０】さらに十分暗い暗表示を実現するには、カラーフィルタを４回通過する際に、異なる色のカラーフィルタを通過することが望ましい。このためカラーフィルタの配列は上下左右で隣り合うカラーフィルタの色ができるだけ異なるようにするためストライプ状ではなく、デルタ配列にすることが望ましい。

【０２７１】また、反射型液晶素子３０００の透明基板３０３０は厚ければ厚いほど、反射型偏光選択部材３００で反射した光が反射型液晶素子３０００の異なる位置を通過して、異なる色のカラーフィルタを通過し易くなるため、透明基板３０３０は実用的な範囲内でできるだけ厚くすることが望ましい。

【０２７２】上記の通り、本実施例６の表示装置によれば、反射型偏光選択部材３００は、透過偏光軸可変部４００による偏光状態の制御により、実効的に透明な状態と、鏡として機能する状態とに切り換えられる。従って、画像表示状態では反射型偏光選択部材３００を実効的に透明な状態とすることで明るい画像が得られる。さらに周囲が明るい環境であっても、ハーフミラーを使用する場合のような映り込みや、それに伴うコントラスト比の低下、画像光の明るさ低下といった画質の劣化が生じない。つまり、画像表示状態と鏡状態の切り換えを互いの性能を劣化することなく実現できる。

【０２７３】ところで、本実施例では反射型液晶パネル３０００に、吸収型偏光選択部材として機能する偏光板を設けない場合を述べた。これは、画像表示状態の明るさを向上するにはできるだけ、光を吸収する部材を減らすことが重要だからである。特にカラー表示が可能な反射型液晶表示パネルではもともと画像が暗いため、吸収型偏光選択部材と、透過偏光軸可変部と、反射型偏光選択部材からなる鏡機能部によってさらに画像が暗くなることが許容されない状況にあるからである。従って、例えば野外など外光が強い場所での使用頻度が高いなどの用途であれば反射型液晶素子３０００に偏光板を設けるようにしてもよい。

【０２７４】さらに、所定の直線偏光成分に対する透過率が１００％に近い高透過率の偏光板であれば、反射型液晶素子３０００、すなわち反射型偏光選択部材３００と透明基板３０３０の間に偏光板の透過偏光軸を反射型偏光選択部材の透過偏光軸と合わせて配置しても画像の明るさはほとんど低減しないので望ましい。この場合、一般に高透過率の偏光板は偏光度が低いため反射型液晶

パネル単体では十分なコントラスト比の画像表示はできないが、吸収型偏光選択部材５００として偏光度が高い偏光板を使用すれば表示性能に問題は生じない。寧ろ、画像表示の際にはより暗い暗表示が実現して高コントラスト比の画像表示が実現できるという利点がある。

【０２７５】つまり、画像表示部材として基板内に反射部を内蔵した反射型液晶表示パネルを用いる場合は、吸収型偏光選択部材に偏光度が高い偏光板を用い、画像表示部材の反射型偏光選択部材側に配置する吸収型偏光選択部材には偏光度が低く、透過率が高い偏光板を用いると、画像の明るさと、高いコントラスト比が両立する。

【０２７６】尚、本実施例では反射型の液晶表示パネルを用いる場合を説明したが、反射部材として機能する画素電極の一部に開口部を設け部分的に透過するようにして、反射表示と透過表示を兼用するようにしてもよい。この場合、反射部材の裏面側には１／４位相差板と偏光板、及び照明装置を配置するとよい。このような構成によれば、夜間や建物内など外光の弱い状況下でも、照明装置を点灯することで画像の表示が可能となる。

【０２７７】（実施例７）本発明の他の実施例を図面をもとに説明する。

【０２７８】図３７を用いて実施例７の鏡状態への切り替え機能付き表示装置を説明する。また、図３８は本表示装置を用いた携帯電話の概観を示す模式図であり、図３８（ａ）は画像表示状態を示し、図３８（ｂ）は鏡状態を示す。図３９は図３８に示した本表示装置を用いた携帯電話の回路構成の一例を示す。

【０２７９】本実施例７の携帯電話８１０は少なくともアンテナ８１１、スピーカー８１２、テンキー等のボタン８１４、マイクロフォン８１５、鏡状態と画像表示状態の切替スイッチ８１３、及び本表示装置の画像表示部１０００と鏡機能部８０１とを含んで構成される。

【０２８０】本実施例７の携帯電話８１０は、電話機能を実現する通信部１０、操作を入力する操作部２０、および、情報表示状態と鏡状態を切替可能な本発明による表示部３０を備えている。通信部１０は、アンテナ８１１と接続して通信信号の送信／受信処理を実行する送信／受信部８２１と、マイクロホン８１５およびスピーカ８１２を通して音声情報の入出力を行うとともに該音声情報と送受信信号との信号変換処理を実施する信号処理部８２２と、入力される操作指示に応じて送受信動作を制御する通信制御部８２３とを備える。操作部２０は、各種操作入力を行うテンキー／ボタン８１４と、情報表示状態と鏡状態を切り替えるための切替スイッチ８１３とを備える。

【０２８１】表示部３０は、照明装置８３６を備えて情報表示を行う画像表示部１０００と、通信部１０や操作部２０からの制御指示を受け入れて表示部の動作制御を行う表示制御部８３１と、表示制御部８３１からの制御信号に応じて画像表示部１０００を駆動する駆動回路部８３２と、画像表示部１０００に重畳配置され鏡状態と透過状態とを選択的に実現する鏡機能部８０１と、鏡機能部８０１の透過偏光軸可変部４００への印加電圧を少なくとも発生する印加電圧発生部８３４と、切替スイッチ８１３からの指示や通信状態に応じて鏡機能部８０１の状態を切り替えるよう印加電圧発生部８３４を制御する鏡制御部８３３と、表示制御部８３１及び鏡制御部８３３からの制御信号に応じて照明装置の点灯、消灯を行う照明スイッチ８３５とを備える。

【０２８２】本表示装置は図３７に示す通り、反射型偏光選択部材３００と透過偏光軸可変部４００と吸収型偏光選択部材５００とを含む鏡機能部８０１の面積を、画像表示部１０００の画像表示領域１００１の面積よりも大きくしたものであり、これ以外は基本的に上記実施例１と同じ構成、機能を有するので上記実施例と同一部には同じ符号を付け詳細な説明は省略する。

【０２８３】鏡機能部８０１の反射型偏光選択部材３００は透過偏光軸可変部４００を構成する基板に透明な粘着材により固定されている。また、反射型偏光選択部材３００が画像表示部１０００と中途半端に接触して干渉縞などが発生することがないように鏡機能部８０１と画像表示部１０００との間は携帯電話のフレーム８１０Ｆに形成された凸部８０１ａをスペーサーとして、一定の空間８０１Ｓを設けている。

【０２８４】ここで、上述の通り、本表示装置は鏡状態のとき、そこにデータ等の情報を表示するのではなく、観察者が自分の顔を映し出し、それを観察することが主たる用途であると規定すると、鏡の大きさは上記の通り、高さ５８．６mm、幅３９．１mm以上あることが望ましい。しかし、画像表示部材は画像表示部を大きくすると消費電力が上がるなどの問題があるため、あまり大きくはできない。一方、鏡機能部はその面積を大きくすることで問題は生じない。よって、本実施の形態７では、鏡機能部の面積を画像表示領域１００１の面積にかかわらず、できるだけ大きくする構成にしている。

【０２８５】また、本表示装置の鏡機能部８０１は透過偏光軸可変部４００による偏光状態の制御により、実効的に透明な状態と、鏡の状態を切り替えることができるものである。従って、大面積の鏡機能部８０１がロゴマーク等のデザインが施された上に配置されても実効的に透明状態の場合には下地に影響を与えないため、機器のデザインの自由度は奪われない。

【０２８６】次に本実施例の携帯電話８１０の動作を図３８を参照して説明する。

【０２８７】図３８（ａ）に示すとおり、携帯電話が使用状態、或いは待機時であっても画像表示を行う場合は、鏡機能部８０１は実効的に透明な状態となっており、明るい画像表示が得られ、また、画像表示部周辺のロゴマークやデザインも可視状態となっている。一方、鏡状態の場合は、図３８（ｂ）に示すとおり画像表示部

よりも大きな鏡面が現れ実用的な鏡が得られることになる。

【０２８８】尚、本実施例７の表示装置は、鏡状態と画像表示状態は切替スイッチ８１３によりワンタッチで行えるよう構成しているため、操作性が高い。切替スイッチ８１３は、透過偏光軸可変部４００の液晶層を挟む一対の電極に±３Ｖ～±５Ｖ程度の交流電圧を印加する場合と、一対の電極を短絡する状態とを切り替えられるように構成する。さらに切替スイッチ８１３に連動して、鏡状態の場合には画像表示部１０００を無表示状態にし、照明装置も消灯するようにして消費電力を低減する。

【０２８９】また、鏡状態から画像表示状態への切替が、着信により自動的に切り替わるように構成することにより、スイッチ操作なしで着信情報を見ることができるためさらに使用者の利便性が向上する。

【０２９０】尚、鏡状態と画像表示状態の切り替えは透過偏光軸可変部４００としてＴＮ液晶素子を用いる場合は数十ｍ秒と高速で切り替わるので、使用者には何ら不便を与えることはない。

【０２９１】また、本実施例では鏡機能部８０１の面積を画像表示領域１００１の面積よりも大きくしたが、本発明において、鏡機能部８０１あるいは鏡状態を実現できる領域の面積と、画像表示領域１００１あるいは透過型／反射型の画像表示部材の面積との比率はこの例に限定されるものではない。もちろん、上記各実施例のように両面積をほぼ同一としても良く、あるいは、鏡機能部の面積をより小さくしたり、特定の領域を除いて鏡機能部を画像表示部に重ねる構成とすることも可能である。例えば、携帯電話が通信可能状態にあるかどうかを示すマークだけが常にチェックできるように、マークの表示部分だけを鏡機能部で覆わない構成とすることができる。

【０２９２】さらに、本実施例では鏡機能部の全面を鏡状態とする場合について説明したが、例えば、鏡機能部の鏡領域を複数に分割して、各分割領域毎に鏡状態と画像表示状態の切り替えを行う構成とすることができる。より具体的には、例えば、透過偏光軸可変部や可変吸収型偏光選択部材への電圧印加を分割した領域毎に行ったり、マトリクス状に画素電極を配置して鏡状態の任意の絵や文字を表示させる構成とすることができる。

【０２９３】（実施例８）本発明の他の実施例を図面をもとに説明する。

【０２９４】図４０、図４１、図４２を用いて、本発明の実施例８について説明する。実施例８において、実施例７と同様な部分については同じ符号をつけて詳細な説明は省略する。

【０２９５】本実施例８の構成は、ユーザーが既存の携帯電話に鏡機能を付与することを可能にする着脱式の鏡機能部である。図４１に示す通り、着脱可能な鏡機能部８０１は、反射型偏光選択部材３００と、透過偏光軸可変部４００と、吸収型偏光選択部材５００とを含んで構成され、これらは互いに透明な粘着材により接着固定されている。また、吸収型偏光選択部材５００の表面にはフィルム、または薄いアクリル板からなる透明な保護部材５００Ｐが透明な粘着材によって貼り合わされている。反射型偏光選択部材３００の周縁部にはスポンジ状で弾性を有する枠状のスペーサー８４３が備えられており、必要に応じてスペーサ８４３の表面に両面テープ８４４が備えられる。このスペーサー８４３は、鏡機能部を携帯電話等の機器に取り付ける際に反射型偏光選択部材３００が、他の部材と接触せず、一定の空間を維持するようにするために配置されている。これにより、反射型偏光選択部材３００と他の部材とが接触して干渉縞などが発生することを防止している。

【０２９６】透過偏光軸可変部４００は、これを構成する透明基板状に形成した透明電極に接続された配線を介して鏡機能駆動部８４０と接続されている。

【０２９７】図４２に示すとおり、鏡機能駆動部８４０は小型電池からなる電源８４５と、切替スイッチ８４６と電源８４５からの電力供給により透過偏光軸可変部４００を駆動する電圧を発生する駆動回路８４７とから構成され、切替スイッチ８４６の操作により透過偏光軸可変部４００を駆動して鏡機能部を鏡状態と透明な状態とに切り替えるものである。

【０２９８】この鏡機能部８０１を携帯電話８１０に取り付ける場合、鏡機能部８０１と鏡機能駆動部８４０との間の配線は、携帯電話のストラップ取り付け部８４１を経由して取り付け、配線８４２及び鏡機能駆動部８４０がストラップであるかのように取り付ける構成とすることができる。この場合、鏡機能駆動部８４０を誤って引っ張ってしまってもその力は携帯電話のストラップ取り付け部８４１で止まり、鏡機能部には直接付加がかからないという利点がある。

【０２９９】（実施例９）本発明の実施例９の表示装置を図４３をもとに説明する。

【０３００】図４３の実施例９の表示装置は、画像光を出射する画像表示部として有機エレクトロルミネッセンス（ＥＬ：electroluminescence）表示パネル９００を用いたものであり、上記実施例１等と同じ部材には同じ符号を付けて詳しい説明は省略する。

【０３０１】本表示装置は、第１の直線偏光の画像光を出射する有機ＥＬ表示パネル９００と、反射型偏光選択部材３００と、透過偏光軸可変部４００と、吸収型偏光選択部材５００とから構成される。有機ＥＬ表示パネル９００は、反射型偏光選択部材３００と対面する側に第１の直線偏光成分は透過し、これと偏光軸が直交する第２の直線偏光成分は吸収する吸収型偏光選択部材２０８と位相差板９０１が配置される。

【０３０２】位相差板９０１としては1/4波長板を用

いれば良く、例えば１軸延伸したポリカーボネート、ポリサルホン、ポリビニルアルコールなどの高分子フィルムを用いることができる。尚、一般に１／４波長板を構成する材質の屈折率の波長依存性（以下、波長分散）により、一種類の位相差板で可視波長の全域に対し１／４波長板として機能する位相差板を構成することは困難であるが、波長分散の異なる少なくとも２種類の位相差板をその光学軸を直交するように貼り合わせることで広い波長域で１／４波長板として機能するよう構成したものを使用することができる。

【０３０３】有機ＥＬ表示パネル９００は有機薄膜からなる発光層に電流を注入することにより電気エネルギーを光エネルギーに変換して発光する自発光型の表示デバイスであり、透明基板９０２にＩＴＯからなる透明電極９０３、ホール輸送層９０４、発光層９０７、電子輸送層９０６、Ａｌ等で構成される反射性の金属電極９０５を順次積層した構造となっている。これらの積層膜は劣化を抑制するために透明基板９０２と封止部材９０９との間に酸素や水分を取り除いた状態でシール剤９０８によって密閉される。

【０３０４】有機EL表示パネルでは、陽極である透明電極９０３と陰極である反射性金属電極９０５との間に直流電圧を印加すると、透明電極９０３から注入されたホールがホール輸送層９０４を経由して、また、陰極（反射性金属電極）９０５から注入された電子が電子輸送層を経由して、それぞれが発光層９０７に到達し、電子−ホールの再結合が生じてここから所定波長の発光が生じると考えられている。発光層９０７から出射する光は一般的には指向性がなく全方位に等方的に出射するため、金属電極９０５に向かった光を効率良く表示光として利用するためには金属電極は反射率の高い電極材料を用いることが望ましい。

【０３０５】尚、有機ＥＬ表示パネル９００の構成は、上記構成に限定されるものではない。つまり、本発明に係る有機ＥＬ表示パネルは少なくとも発光層と、発光層の裏面に配置した反射性部材とから構成される自発光型の表示デバイスを用いることができる。

【０３０６】次に、図４３を用いて本実施例９の表示装置の動作を説明する。図４３の、右側が画像表示状態、左側が鏡状態を示す。

【０３０７】表示装置が画像表示状態の場合、透過偏光軸可変部４００はこれを構成する液晶層４０７に電圧を印加しない状態、すなわちオフ状態とする。画像表示状態の場合、発光層から出射した光は直接、或いは裏面の金属電極９０５で反射した後、透明基板９０２から出射する。

【０３０８】透明基板９０２から出射した画像光３２０１は位相差板９０１を透過し、吸収型偏光選択部材２０８を通過する際、第１の直線偏光成分は透過し、これと偏光軸が直交する第２の直線偏光成分は吸収される。吸収型偏光選択部材２０８を透過した画像光３２０１は反射型偏光選択部材３００も透過して、透過偏光軸可変部４００に入射する。この場合、透過偏光軸可変部４００を通過する画像光３２０１は第１の直線偏光から第２の直線偏光に変化する。透過偏光軸可変部４００を透過した画像光３２０１は吸収型偏光選択部材５００に入射する。吸収型偏光選択部材５００は第１の直線偏光成分は吸収し、第２の直線偏光成分は透過するため、透過偏光軸可変部４００により第２の直線偏光光に変化した画像光３２０１は吸収型偏光選択部材５００を透過して、観察者2000に観察される。

【０３０９】一方、観察者2000側から表示装置へ入射する外光３２０２は、非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過する。吸収型偏光選択部材５００を透過した外光３２０２は透過偏光軸可変部４００を透過する際、第２の直線偏光光から第１の直線偏光光に変化し、反射型偏光選択部材３００を透過して有機ＥＬ表示パネル９００に入射する。

【０３１０】有機ＥＬ表示パネル９００に入射した外光３２０２は吸収型偏光選択部材２０８を透過して、位相差板９０１を透過する際、その作用を受けて、円偏光（ここでは例えば右回りの円偏光）となる。位相差板９０１を透過した外光３２０２は金属電極９０５で反射する際、位相がπずれて回転方向が逆の円偏光（左回りの円偏光）になる。金属電極９０５で反射した外光３２０２は再び位相差板９０１を透過する際、その作用を受けて今度は第２の直線偏光となり吸収型偏光選択部材２０８で吸収されるため観察者２０００側へは戻らない。

【０３１１】従って、画像表示状態では、有機ＥＬ表示パネル９００から出射した画像光３２０１はほとんど損失することなく観察者へ向かうため明るい画像を得ることができる。また、周囲から表示装置に入射する外光３２０２は鏡状態の場合に鏡として機能する反射型偏光選択部材３００での反射はなく、さらに、有機ＥＬ表示パネル９００の金属電極９０５で反射した光は吸収型偏光選択部材２０８で吸収されるため、観察者２０００にほとんど視認されない。つまり、外光の不要反射が抑制された、コントラスト比の高い画像表示が実現できる。

【０３１２】一方、表示装置を鏡状態とする場合、透過偏光軸可変部４００はこれを構成する液晶層４０７に電界を印加してオン状態とする。鏡状態の場合、観察者２０００側から表示装置へ向かう外光３２０３は非偏光であるが、吸収型偏光選択部材５００を透過する際、第１の直線偏光成分は吸収され、第２の直線偏光成分のみが透過して透過偏光軸可変部４００に入射する。このとき透過偏光軸可変部４００に入射した外光３２０３は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光光のまま透過し、反射型偏光選択部材３００に至る。反射型偏光選択部材３００では第１の直線偏光成

分は透過し、第２の直線偏光成分は鏡面反射するため、外光３２０３は反射型偏光選択部材３００で反射する。反射型偏光選択部材３００で反射した外光３２０３は透過偏光軸可変部４００を偏光軸が変化することなく第２の直線偏光のまま透過し、さらに偏光選択部材５００も透過して観察者へ向かうため鏡状態が実現する。

【０３１３】このとき、鏡状態となっている領域に該当する有機ＥＬ表示パネル９００の表示領域は、鏡機能の動作と連動して、非発光の状態とすることが望ましい。この動作により、反射型偏光選択部材３００の裏面側からの光の漏れを完全になくすことができるため、高いコントラスト比の反射像を映し出す高品位な鏡を実現することができ、さらに発光量を抑制した分だけ表示装置の消費電力が低減される。

【０３１４】ただし、必ずしも非発光の状態にしなくともよく、有機ＥＬ表示パネル９００から画像光が出射している場合であっても、有機ＥＬ表示パネル９００から出射する画像光は吸収型偏光選択部材２０８を透過した第１の直線偏光光であるため、反射型偏光選択部材３００を透過し、透過偏光軸可変部４００を偏光軸が変化することなく第１の直線偏光光のまま透過して、吸収型偏光選択部材５００で吸収されて観察者２０００にはほとんど観察されないため、高いコントラスト比の反射像を映し出す鏡を実現することはできる。

【０３１５】尚、吸収型偏光選択部材２０８や吸収型偏光選択部材５００として機能する偏光板の特性は画像表示状態の画質や鏡状態の鏡の見え易さに直接関係する。このため、実施例１と同様、画像表示状態において十分なコントラスト比を維持しつつ、輝度を向上するためには吸収型偏光選択部材２０８と吸収型偏光選択部材５００のどちらか一方の偏光板に偏光度の高い偏光板を用い、他方に偏光度の低い偏光板を用いることが有効である。

【０３１６】上述してきた各実施例のように、本発明の表示装置によれば、鏡として機能する反射型偏光選択部材が、実効的に透明な状態と、鏡として機能する状態とに任意に切り換えられるので、画像表示状態と鏡状態の切り換えを互いの性能を劣化することなく実現できるという効果がある。つまり、画像表示状態では画像光がほとんど損失しない明るい画像が得られ、周囲が明るい環境であっても、映り込みやそれに伴うコントラスト比の低下といった外光に起因した画質の劣化がない高品位な画像が得られるという効果がある。

【０３１７】一方、鏡状態では、外光を効率良く反射するため明るい鏡を実現でき、さらに画像光の光の漏れが抑制されるため、コントラスト比が高い反射像を映し出す鏡を実現できるという効果がある。従って、鏡状態のときには、人が自分の顔や姿を映して観察するのに適した見やすい反射像が得られる。

【０３１８】

【発明の効果】上述してきたように、本発明によれば、高画質な画像を表示する状態と、人が自分の顔や姿を映して観察するのに適した見やすい反射像が得られる鏡状態とに切り替え可能な装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態の鏡状態への切り替え機能付き表示装置の基本構成と動作を表示装置の基本構成と動作を説明するための説明図である。

【図２】本発明の第１の実施の形態の鏡状態への切り替え機能付き表示装置の基本構成と動作を表示装置の基本構成と動作を説明するための説明図である。

【図３】図１、図２の表示装置が鏡状態の場合の明表示領域の光の漏れを示すグラフである。

【図４】図１、図２の表示装置が鏡状態の場合の暗表示領域の光の漏れを示すグラフである。

【図５】本発明の第２の実施の形態の鏡状態への切り替え機能付き表示装置の基本構成と動作を表示装置の基本構成と動作を説明するための説明図である。

【図６】本発明の第２の実施の形態の鏡状態への切り替え機能付き表示装置の基本構成と動作を表示装置の基本構成と動作を説明するための説明図である。

【図７】本発明の実施例１の表示装置の構成を示す断面図である。

【図８】本発明の実施例１の表示装置を構成する各部材の断面図である。

【図９】本発明の実施例１の表示装置を構成する各部材の軸の方向の説明図である。

【図１０】本発明の実施例１の表示装置の動作を説明するための説明図である。

【図１１】本発明の実施例１の表示装置の動作を説明するための説明図である。

【図１２】一般的な偏光板の偏光度と透過率の関係の一例を示すグラフである。

【図１３】本発明の実施例１の表示装置に係る吸収型偏光選択部材５００の偏光度と、鏡状態での反射率及び画像表示状態での外光の反射率との関係を示すグラフである。

【図１４】本発明の実施例１の表示装置に係る吸収型偏光選択部材２０８の偏光度と、画像表示状態での表示輝度の関係を示すグラフである。

【図１５】本発明の実施例２の表示装置の構成を示す断面図である。

【図１６】本発明の実施例２の表示装置を構成する各部材の断面図である。

【図１７】本発明の実施例２の表示装置の可変偏光選択部材６００の構成の一例を示す断面図である。

【図１８】本発明の実施例２の表示装置の可変偏光選択部材６００の構成の一例を示す断面図である。

【図１９】本発明の実施例２の表示装置を構成する各部材の軸の方向の説明図である。

【図２０】本発明の実施例２の表示装置の動作を示す説明図である。

【図２１】本発明の実施例２の表示装置の動作を示す説明図である。

【図２２】本発明の実施例３の表示装置の概略構成を示す説明図である。

【図２３】本発明の実施例３の表示装置の透過型スクリーンの部分断面図である。

【図２４】本発明の実施例３の表示装置のレンチキュラレンズシートの一例を示す一部断面図である。

【図２５】本発明の実施例３の表示装置のレンチキュラレンズシートの一例を示す一部斜視図である。

【図２６】本発明の実施例３の表示装置に係る透過型スクリーンの部分断面図である。

【図２７】本発明の実施例４の表示装置を構成する各部材の断面図である。

【図２８】本発明の実施例４の表示装置を構成する各部材の軸の方向の説明図である。

【図２９】本発明の実施例５の表示装置を構成する各部材の断面図である。

【図３０】本発明の実施例５の表示装置を構成する各部材の軸の方向の説明図である。

【図３１】本発明の実施例５の表示装置の動作を説明するための説明図である。

【図３２】本発明の実施例６の表示装置を構成する各部材の断面図である。

【図３３】本発明の実施例６の表示装置を構成する各部材の軸の方向の説明図である。

【図３４】本発明の実施例６の表示装置の動作を説明するための説明図である。

【図３５】本発明の実施例６の表示装置の動作を説明するための説明図である。

【図３６】本発明の表示装置の動作を説明するための概略構成図である。

【図３７】本発明の実施例７の表示装置の一部断面図である。

【図３８】（ａ），（ｂ）本発明の実施例７に係る携帯電話の概観を示す上面図である。

【図３９】本発明の実施例７に係る携帯電話の概略機能構成を示すブロック図である。

【図４０】本発明の実施例８に係る携帯電話の概観を示す上面図である。

【図４１】本発明の実施例８に係る着脱可能な鏡機能部の一例を示す一部断面図である

【図４２】本発明の実施例８に係る鏡機能部の駆動部の概略機能構成を示すブロック図である。

【図４３】本発明の実施例９の表示装置の一例を示す一部断面図である。

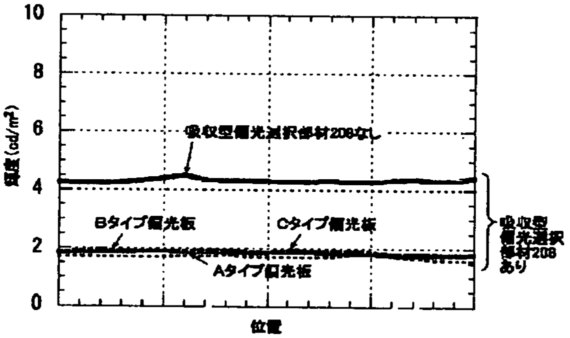
【図４４】従来の表示装置のシャッタ状態における光の漏れを示すグラフである。

【符号の説明】

１００…照明装置、２００…液晶表示パネル、２０８…吸収型偏光選択部材、３００…反射型偏光選択部材、３０１…反射型偏光選択部材、４００…透過偏光軸可変部、５００…吸収型偏光選択部材、６００…可変偏光選択部材、７０１…投射装置、７０２…ミラー、７０３…透過型スクリーン。

【図３】

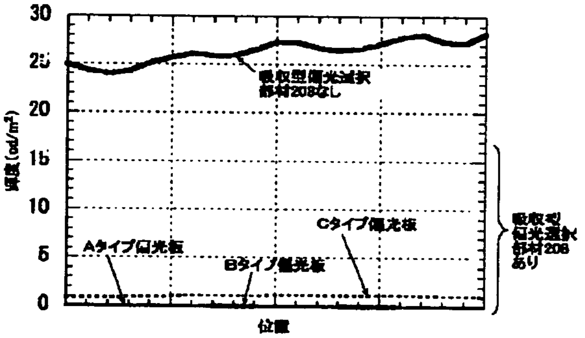
図３



鏡状態での明表示領域の光漏れ

【図４】

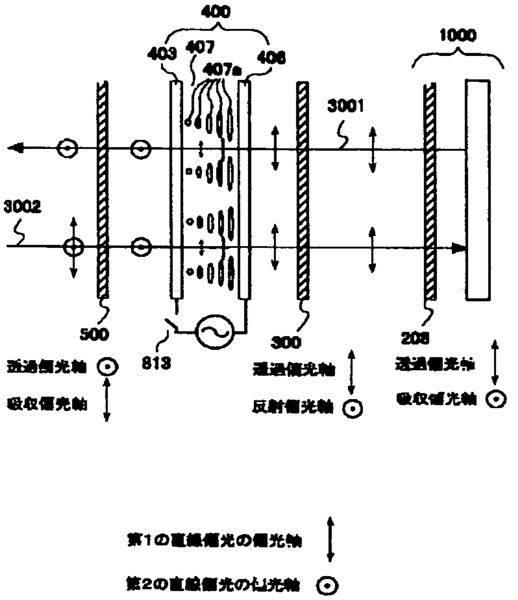
図４



鏡状態での暗表示領域の光漏れ

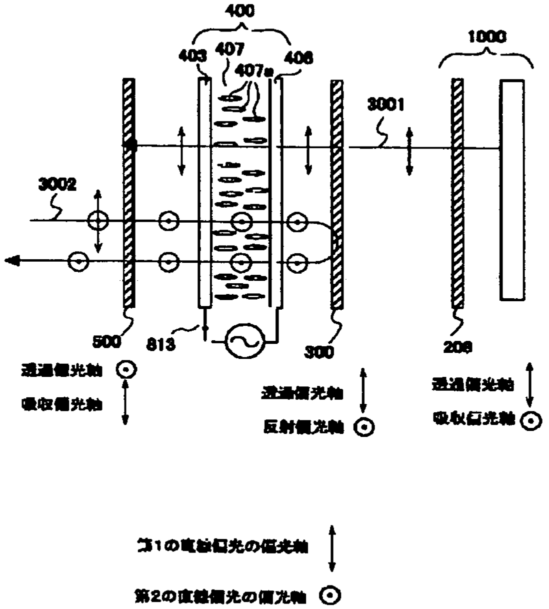
【図1】

図1



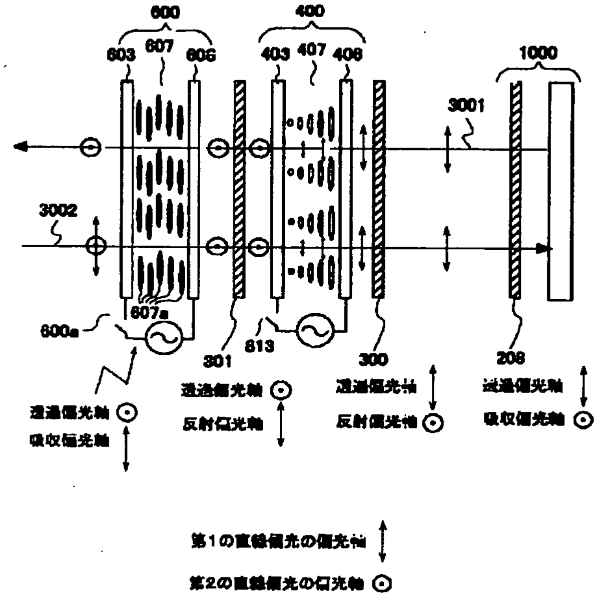
【図2】

図2



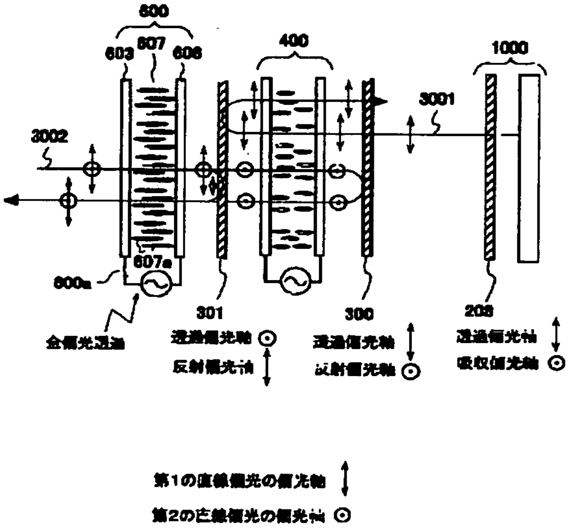
【図5】

図5



【図6】

図6



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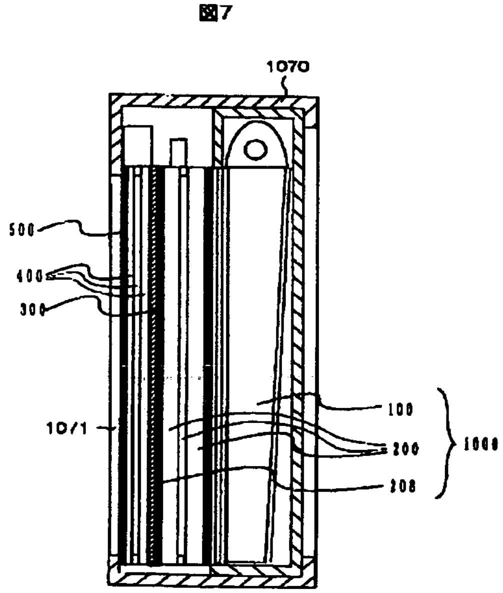


図7
10/1

【図8】

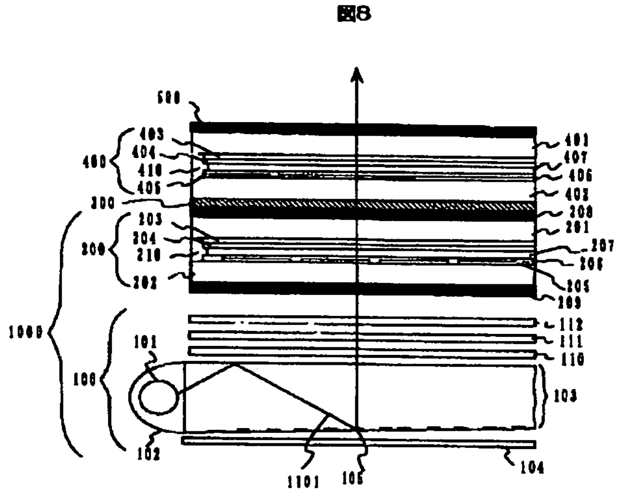


図8

【図9】

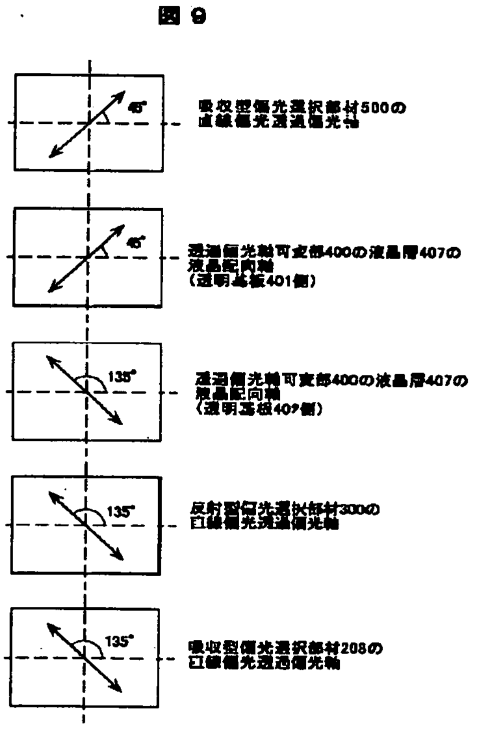


図 9
45°
吸収型偏光選択部材500の
直線偏光透過偏光軸
45°
透過偏光軸可変部400の液晶層407の
液晶配向軸
(透明基板401側)
135°
透過偏光軸可変部400の液晶層407の
液晶配向軸
(透明基板409側)
135°
反射型偏光選択部材300の
直線偏光透過偏光軸
135°
吸収型偏光選択部材208の
直線偏光透過偏光軸

【図10】

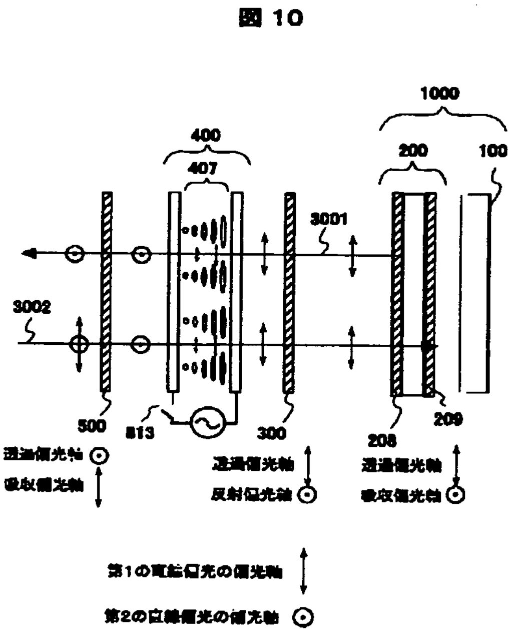
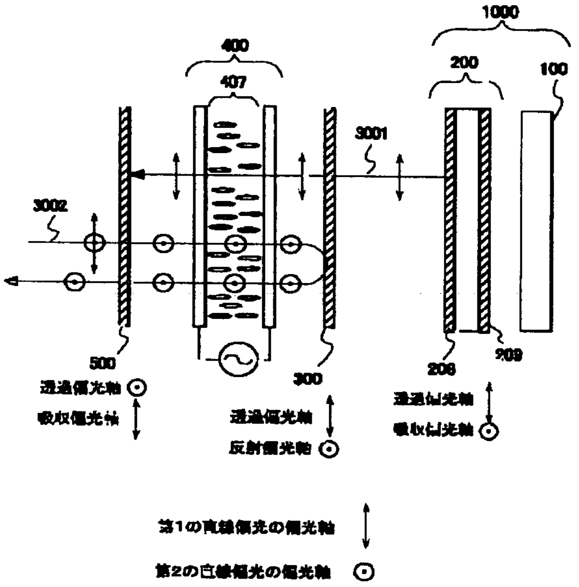


図 10
1000
400
407
200
100
3001
3002
500
813
300
208
209
透過偏光軸 ⊙
吸収偏光軸 ↕
透過偏光軸 ↕
反射偏光軸 ⊙
透過偏光軸 ↕
吸収偏光軸 ⊙
第1の直線偏光の偏光軸 ↕
第2の直線偏光の偏光軸 ⊙

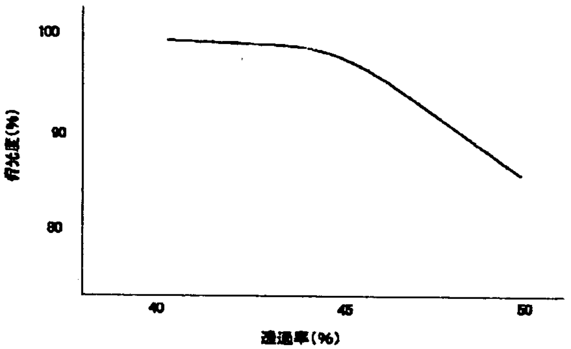
【図11】

**図 11**



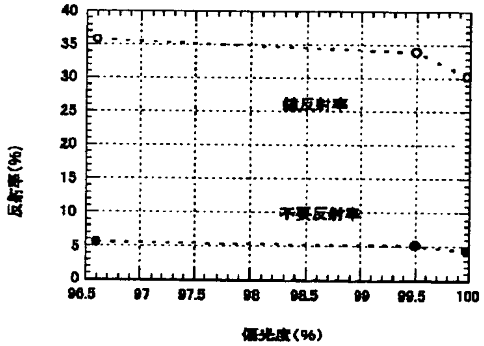
【図12】

**図12**



【図13】

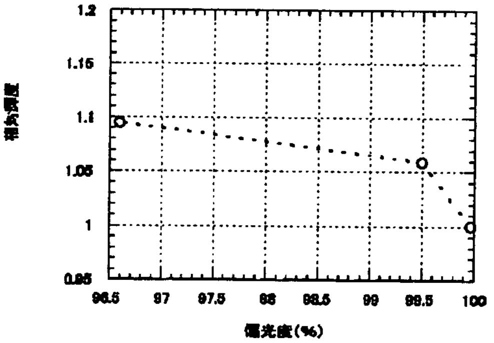
**図13**



吸収型偏光選択部材500の偏光度と鏡状態での反射率及び画像表示状態での不要反射率の関係

【図14】

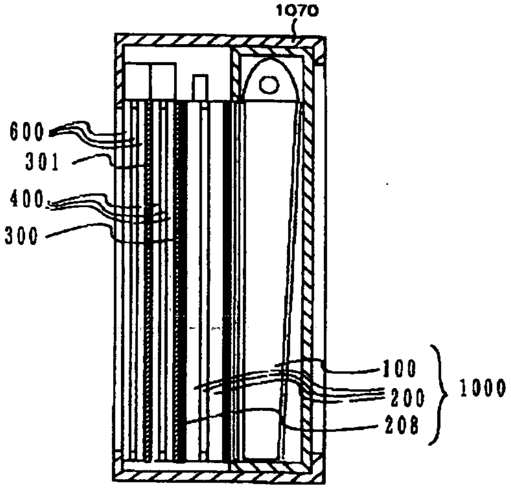
**図14**



吸収型偏光選択部材208の偏光度と表示輝度の関係

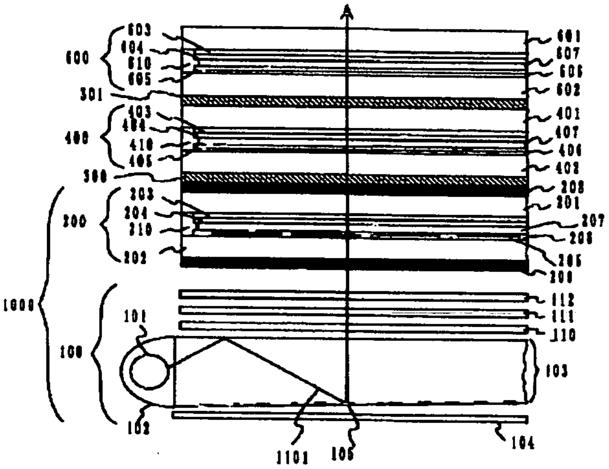
【図15】

図15



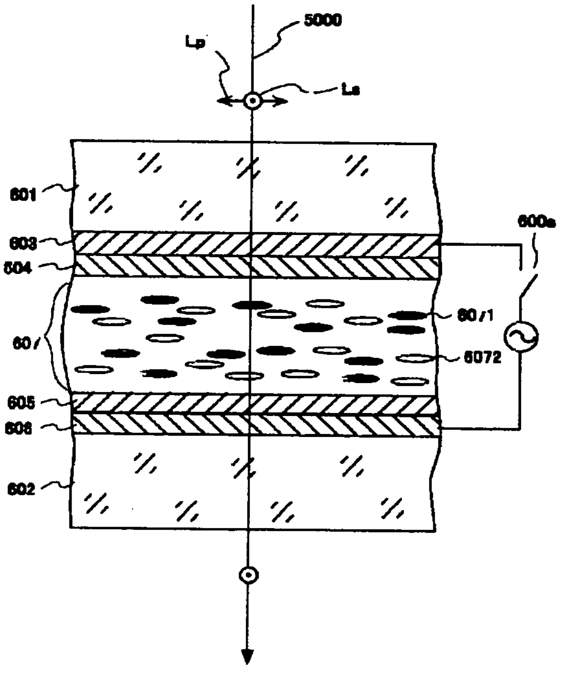
【図16】

図16



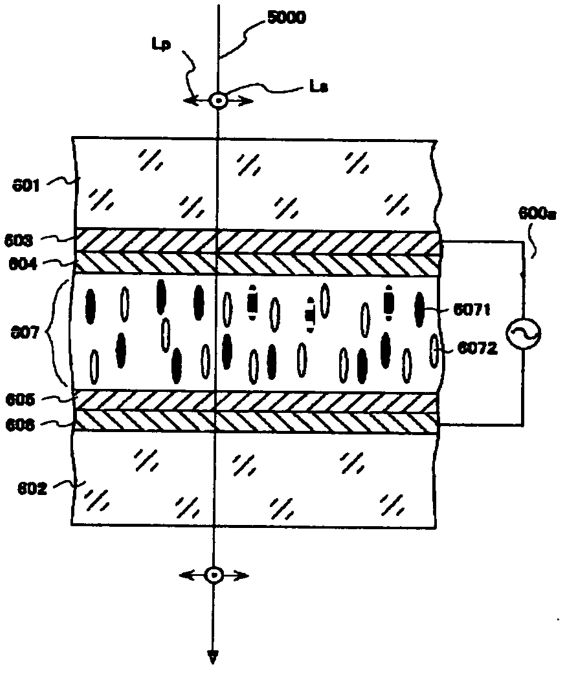
【図17】

図17



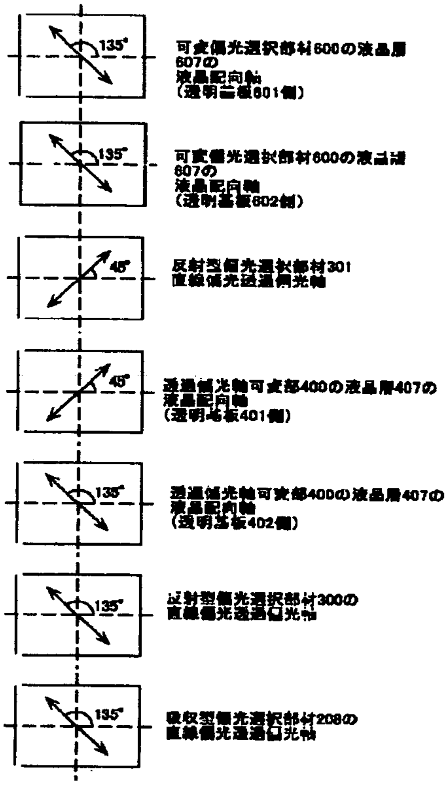
【図18】

図18



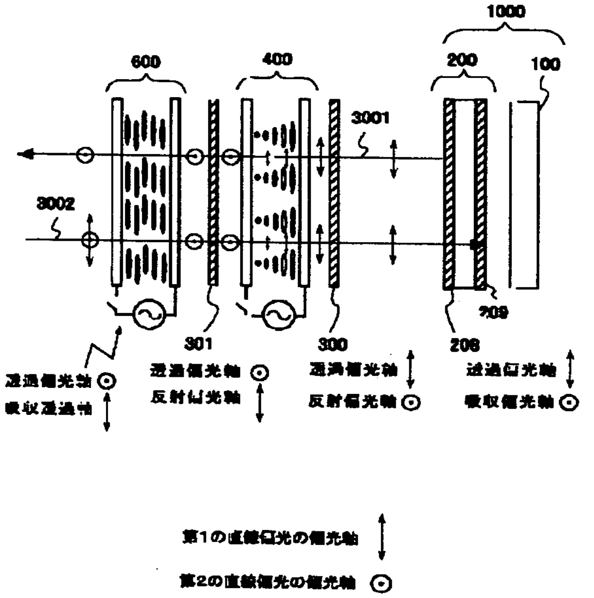
【図19】

図 19



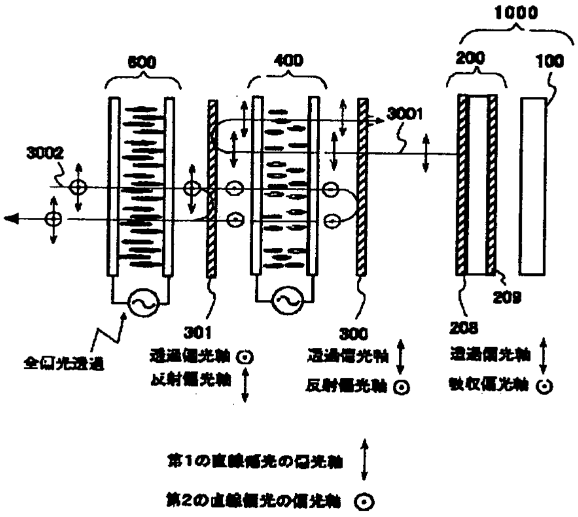
【図20】

図 20



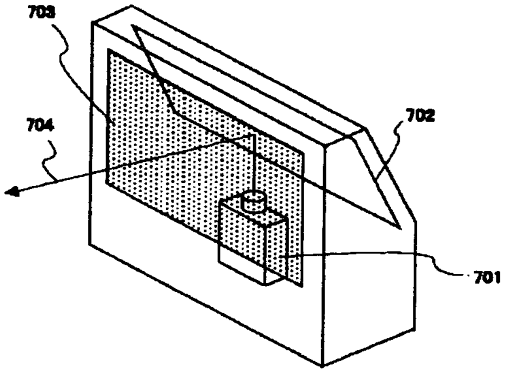
【図21】

図 21



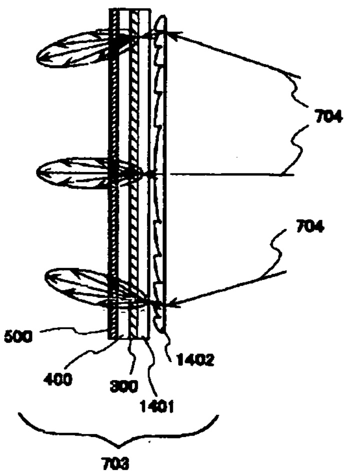
【図22】

図 22



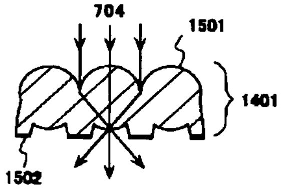
【図23】

図 23



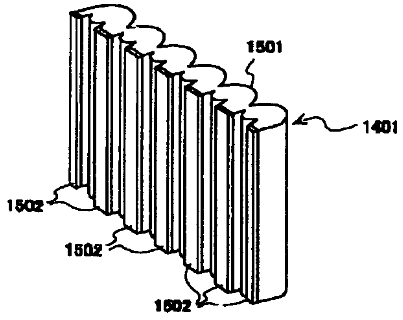
【図24】

図 24



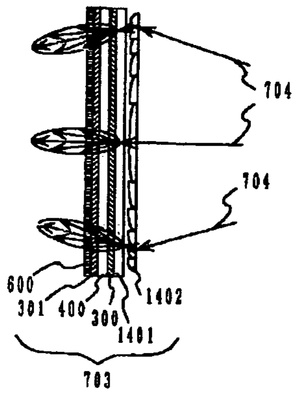
【図25】

図 25



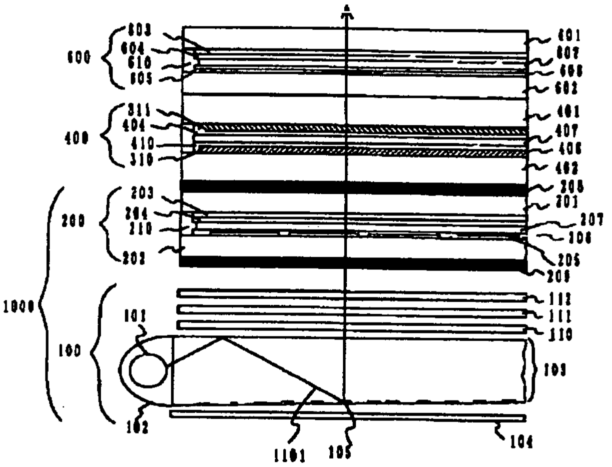
【図26】

図26



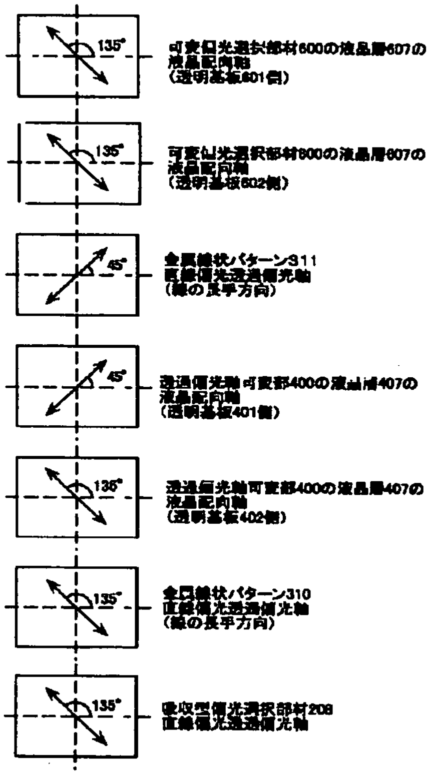
【図27】

図27



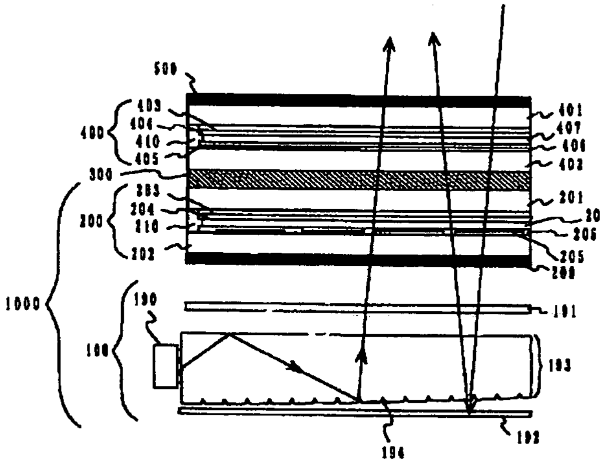
【図28】

図 28



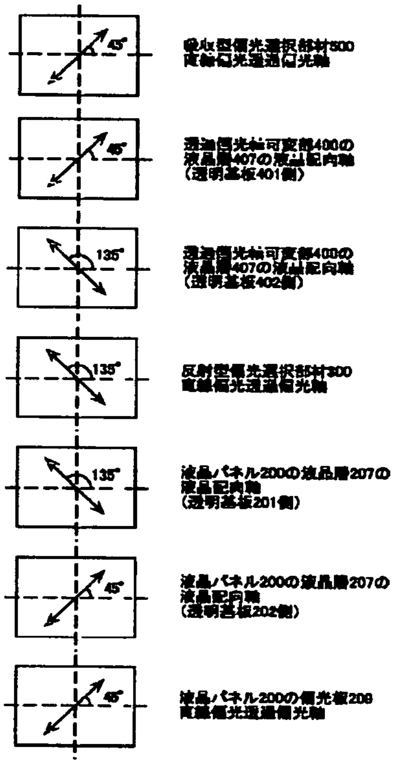
【図29】

図29



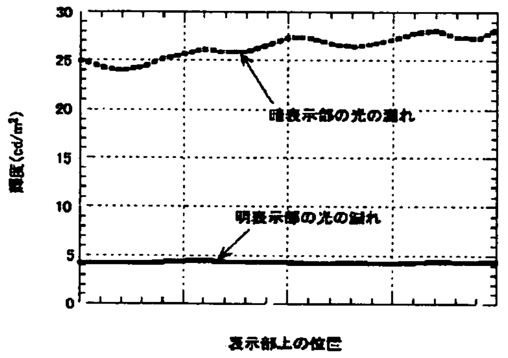
【図30】

図 30



【図44】

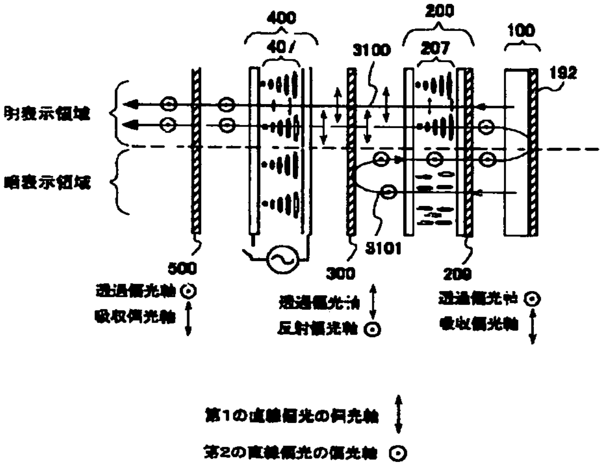
図 44



従来技術シャッタ状態(鏡状態)での光の漏れ(正面方向)

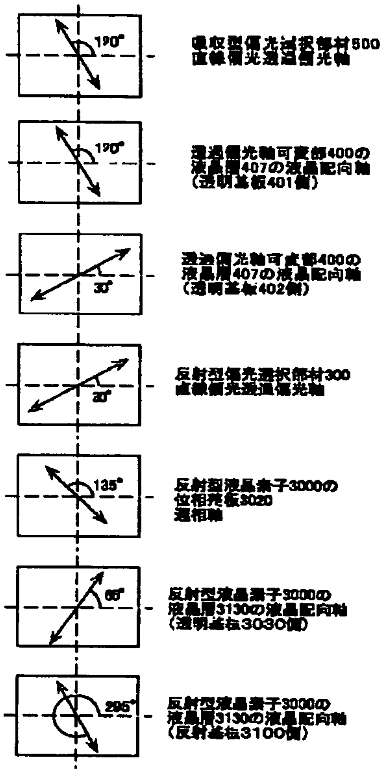
【図３１】

図31



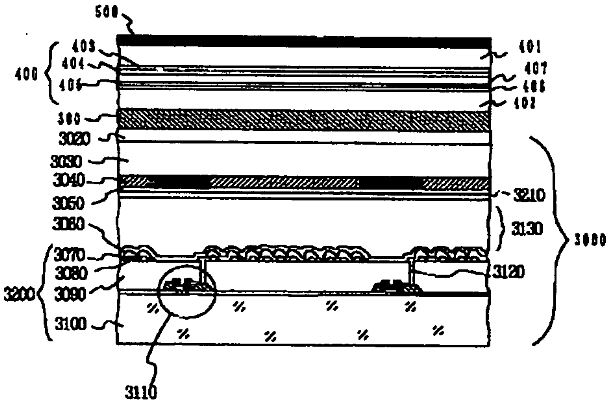
【図３３】

図 33



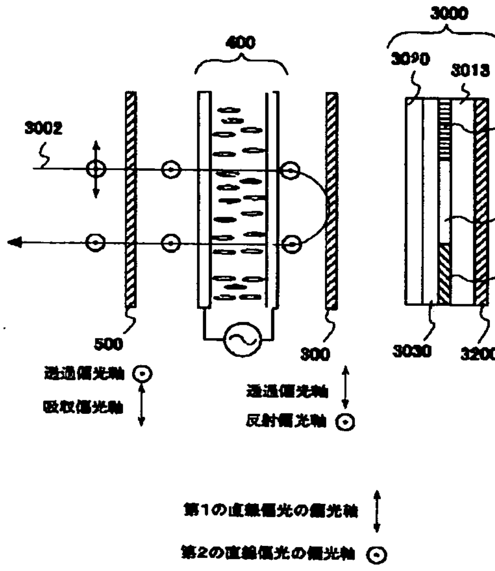
【図３２】

図32



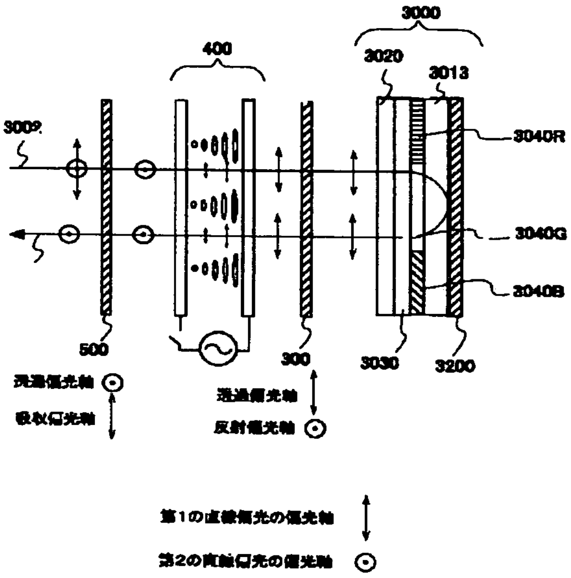
【図34】

図 34



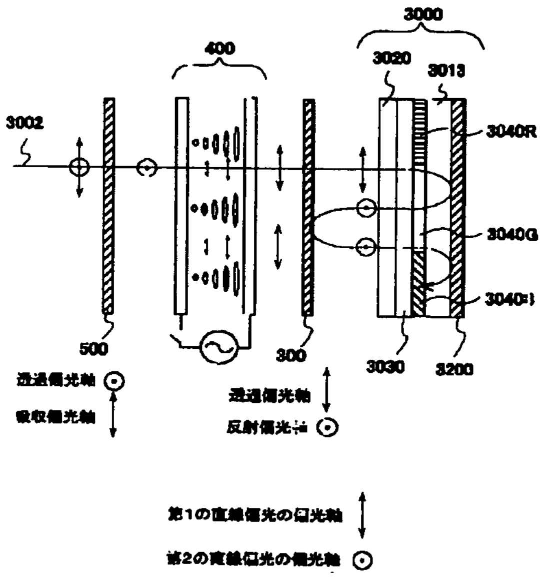
【図35】

図 35



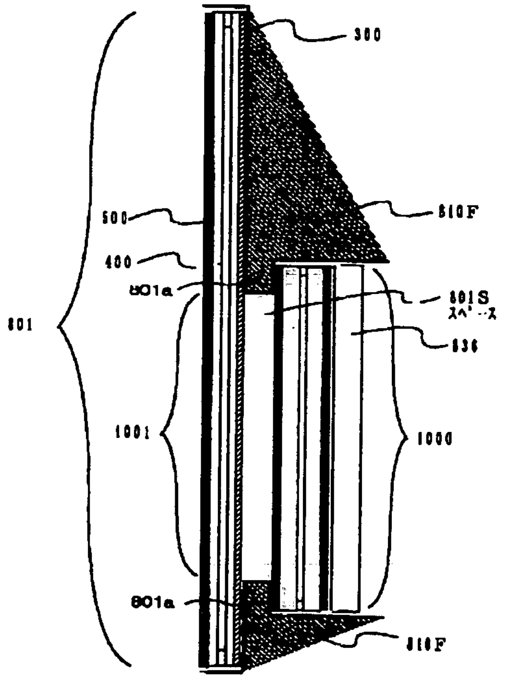
【図36】

図 36



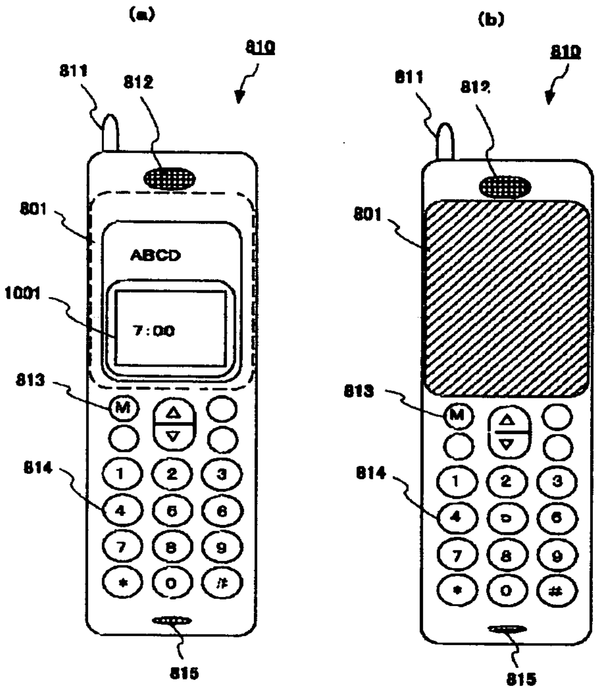
【図37】

図37



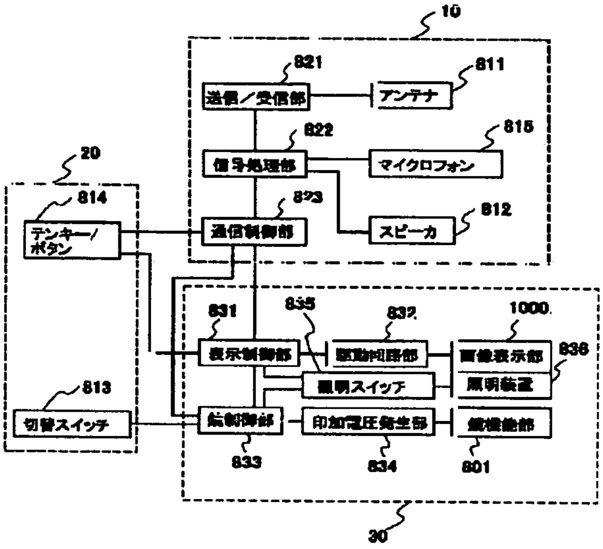
【図38】

図 38



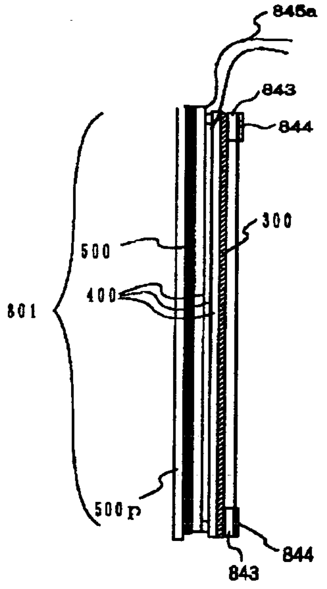
【図39】

図 39



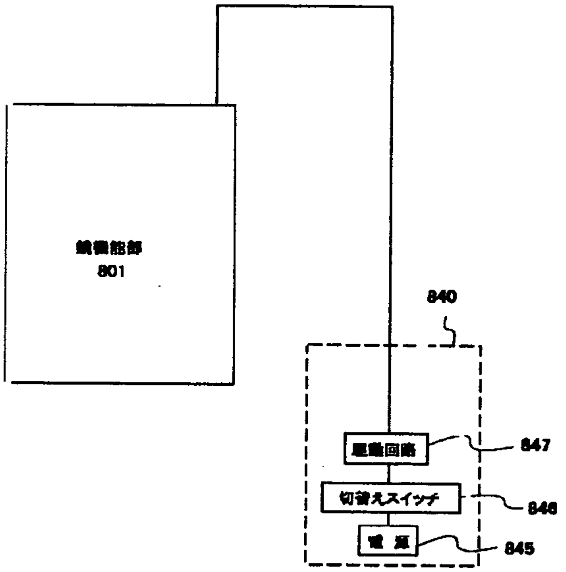
【図41】

図41



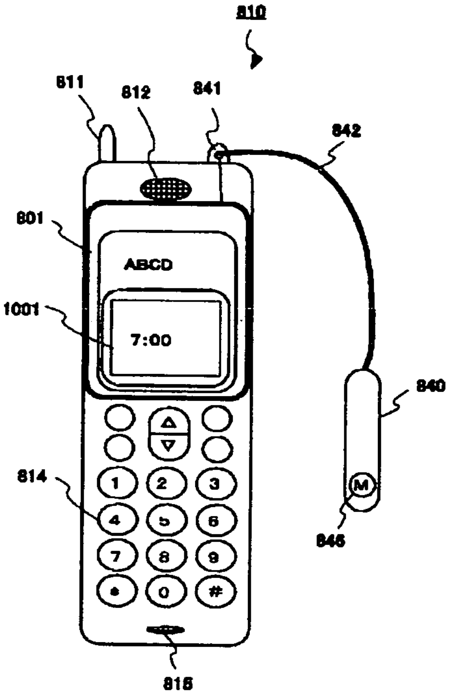
【図42】

図 42



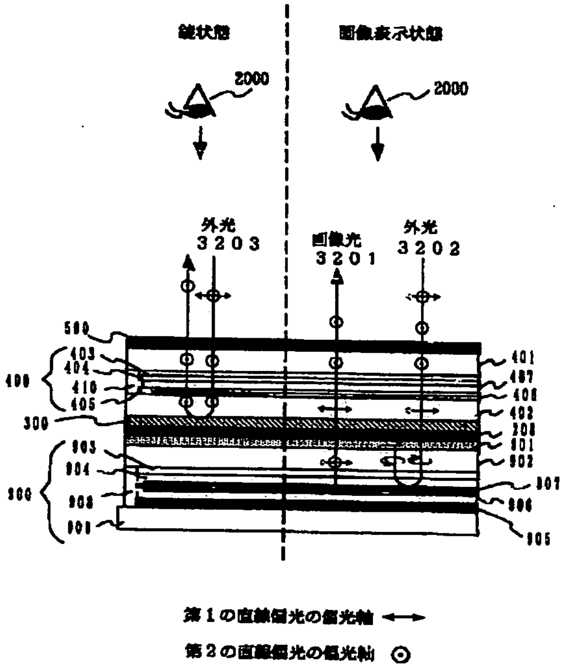
【図40】

図 40



【図43】

図43



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(30)Priority

Priority number : 2000054960 Priority date : 29.02.2000 Priority country : JP

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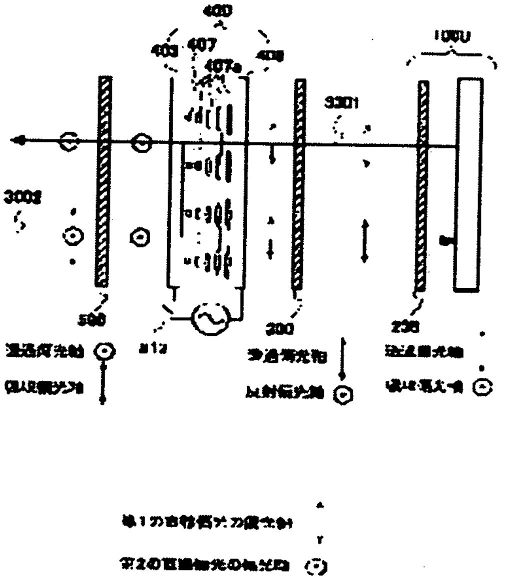
## (54) DEVICE WHICH CAN BE SWITCHED BETWEEN IMAGE DISPLAY STATE AND MIRROR STATE AND APPARATUS EQUIPPED WITH THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a device which can be switched between a state to display an image of high picture quality and a mirror state to give a reflection image which is easily visible and suitable for an user to reflect and observe his/her face or posture.

SOLUTION: The following members are successively disposed in the device: an image display part 1000 which emits image light 3001, a reflection type polarization selecting means 300 which transmits a first linearly polarized light component emitted from the image display part 1000 and reflects a second linearly polarized light component having the polarization axis perpendicular to that of the first component, a varying part 400 for the polarization axis of the transmitted light which can select either a state to change the polarization axis of the incident linearly polarized light or a state not to change the light, and a polarization selecting member 500 which absorbs the first linearly polarized component light in the incident light and transmits the second linearly polarized component having the polarization axis perpendicular to that of the first

図 1



light. The image display part 1000 is provided with an absorption type polarization selecting means 208 to emit the first linearly polarized light as the image light.

LEGAL STATUS

| | |
|---|---|
| [Date of request for examination | 07.10.2002 |
| [Date of sending the examiner's decision of rejection] | |
| [Kind of final disposal of application other than the examiner's decision of rejection or application converted registration] | |
| [Date of final disposal for application] | |
| [Patent number] | 3419766 |
| [Date of registration] | 18.04.2003 |
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| [Date of requesting appeal against examiner's decision of rejection] | |
| [Date of extinction of right] | |

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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## CLAIMS

[Claim(s)]
[Claim 1] Superimposed on the image display section which carries out outgoing radiation of the image light for displaying a desired image, and said image display section, and have been arranged. It has a switchable mirror function part in the image transparency condition which penetrates said image light, and the mirror condition of reflecting outdoor daylight. This mirror function part The reflective mold polarization selection means arranged sequentially from said image display section side, a transparency polarization shaft adjustable means, and an absorption mold polarization selection means are included. Said reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means Are switchable in the condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, and the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said absorption mold polarization selection means One side is penetrated among said 1st polarization and said 2nd polarization, and another side is absorbed. Said image display section It is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.
[Claim 2] In equipment according to claim 1, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means By changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said mirror function part to said image transparency condition, and changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence.
[Claim 3] In equipment according to claim 1, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means By changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said mirror function part to said image transparency condition, and changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization.
[Claim 4] Superimposed on the image display section which carries out outgoing radiation of the image light for displaying a desired image, and said image display section, and have been arranged. It has a switchable mirror function part in the image transparency condition which penetrates said image light, and the mirror condition of reflecting outdoor daylight. This mirror function part The 1st reflective mold polarization selection means arranged sequentially from said image display section side, A transparency polarization shaft adjustable means, the 2nd reflective mold polarization selection means, and an adjustable polarization selection means are included. Said 1st reflective

mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means The condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, Are switchable in the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said 2nd reflective mold polarization selection means One side is reflected among said 1st polarization and said 2nd polarization, and another side is penetrated. Said adjustable polarization selection means Are switchable in the condition of absorbing one side among said 1st polarization and the 2nd polarization, and penetrating another side, and the condition of penetrating all polarization components. Said image display section It is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.

[Claim 5] In equipment according to claim 4, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means While changing said 1st polarization to the condition of making it changing to said 2nd polarization, said transparency polarization shaft adjustable means By changing to the condition of absorbing said 1st polarization for said adjustable polarization selection means, and penetrating said 2nd polarization While changing said mirror function part to said image transparency condition and changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said adjustable polarization selection means to the condition of penetrating said all polarization components.

[Claim 6] In equipment according to claim 4, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means While changing said transparency polarization shaft adjustable means to the condition of penetrating without changing said polarization shaft which carried out incidence By changing to the condition of absorbing said 2nd polarization for said adjustable polarization selection means, and penetrating said 1st polarization While changing said mirror function part to said image transparency condition and changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said adjustable polarization selection means to the condition of penetrating said all polarization components.

[Claim 7] Superimposed on the image display section which carries out outgoing radiation of the image light for displaying a desired image, and said image display section, and have been arranged. It has a switchable mirror function part in the image transparency condition which penetrates said image light, and the mirror condition of reflecting outdoor daylight. This mirror function part The 1st reflective mold polarization selection means arranged sequentially from said image display section side, a transparency polarization shaft adjustable means, and the 2nd reflective mold polarization selection means are included. Said 1st reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means The condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, Are switchable in the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said 2nd reflective mold polarization selection means One side is reflected among said 1st polarization and said 2nd polarization, and another side is penetrated. Said image display section It is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.

[Claim 8] It is switchable equipment about the image display condition and mirror condition which are characterized by changing said image display section to the condition of making it this interlocked with and not carrying out outgoing radiation of said image light when said image display section is switchable in the condition of not carrying out outgoing radiation of said image light, in equipment given in claims 2, 3, 5, or 6 and said change means changes said mirror function part to said mirror condition.

[Claim 9] Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by switching off said lighting system or changing said liquid crystal device to a dark display in order to change said image display section to the condition that said change means does not carry out outgoing radiation of said image light in equipment according to claim 8 including a lighting system and a liquid crystal device.

[Claim 10] In equipment according to claim 8 said transparency polarization shaft adjustable means It is a configuration switchable in the condition of penetrating only some fields without changing said polarization shaft which carried out incidence. Said change means When only said some of fields are changed to the condition of penetrating without changing said polarization shaft which carried out incidence It is switchable equipment about the image display condition and mirror condition which are characterized by changing the display of said image display section of the part which overlaps said some of fields to a dark display, and not carrying out outgoing radiation of said image light from the part concerned.

[Claim 11] It is. equipment according to claim 1, 4, or 7 -- said transparency polarization shaft adjustable means A liquid crystal layer and the electrode for impressing electric field in the direction of thickness of this liquid crystal layer are included. This liquid crystal layer When it is the configuration that the direction of a major axis of a liquid crystal molecule becomes parallel to the direction of thickness when the direction of a major axis of a liquid crystal molecule is continuously twisted 90 degrees in the direction of thickness when electric field are not impressed, and electric field are impressed, and said mirror function part is in a mirror condition, Said transparency polarization shaft adjustable means is switchable equipment about the image display condition and mirror condition which are characterized by being in the condition of impressing electric field to said liquid crystal layer.

[Claim 12] It is. equipment according to claim 1, 4, or 7 -- said transparency polarization shaft adjustable means A liquid crystal layer and the electrode for impressing electric field in the direction of thickness of this liquid crystal layer are included. This liquid crystal layer When it is the configuration that the direction of a major axis of a liquid crystal molecule becomes parallel to the direction of thickness when the direction of a major axis of a liquid crystal molecule is continuously twisted 90 degrees in the direction of thickness when electric field are not impressed, and electric field are impressed, and said mirror function part is in a mirror condition, Said transparency polarization shaft adjustable means is switchable equipment about the image display condition and mirror condition which are characterized by being in the condition of not impressing electric field to said liquid crystal layer.

[Claim 13] It is switchable equipment about the image display condition and mirror condition which are characterized by filling the relation of 0.966 <=P1 <=0.995 <=P2 in equipment according to claim 1 when the degree of polarization of P1 and said absorption mold polarization selection means is set to P2 for the degree of polarization of said polarization selection means for image light.

[Claim 14] When the degree of polarization of P1 and said absorption mold polarization selection means is set to P2 for the degree of polarization of said polarization selection means for image light in equipment according to claim 1, It is switchable equipment about the image display condition and mirror condition which are characterized by changing said image display section to the condition of making it this interlocked with and not carrying out outgoing radiation of said image light when the relation of 0.966 <=P2 <=0.995 <=P1 is filled and said mirror function part is changed to said mirror condition.

[Claim 15] Said 1st reflective mold polarization selection means is switchable equipment about the image display condition and mirror condition which are characterized by being arranged so that spacing with said 2nd reflective mold polarization selection means may be set to 0.11mm or less in equipment according to claim 4 or 7.

[Claim 16] It is switchable equipment about the image display condition and mirror condition which are characterized by the area size from which said mirror function part will be in a mirror condition

in equipment according to claim 1, 4, or 7 being 58.6mmx39.1mm at least.
[Claim 17] Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by arranging the phase contrast plate and said polarization selection means for image light in equipment according to claim 1 including an organic electroluminescence display device between the luminous layer of an organic electroluminescence display device, and said reflective mold polarization selection means.
[Claim 18] The image display section which carries out outgoing radiation of the light which has the 1st polarization condition, and the image display condition which is overlapped on said image display section, is arranged, and penetrates the image light from said image display member, The actuation is interlocked with, when it has a selectable mirror function part and said mirror function part is changed to a mirror condition in either, while in the mirror condition of reflecting the light which goes to said image display member from the exterior. The display characterized by establishing the change means which changes the luminescence condition of said image display member to a nonluminescent condition.
[Claim 19] The transparence substrate of a pair to which said image display section was joined with the fixed gap in the display according to claim 18, The liquid crystal layer pinched between these transparence substrates, and the pixel electrode group arranged in the shape of [ which is formed at least in one side of the transparence substrate of said pair with a transparent electrode ] a matrix, A polarization selection means for a display to penetrate said 1st linearly polarized light component arranged to the check-by-looking side of this liquid crystal layer, and to absorb said 2nd linearly polarized light component, It is the display which has the polarizing plate arranged to the rear-face side of this liquid crystal layer, and the lighting system further arranged at the tooth back, and is characterized by said change means switching off said lighting system when said mirror function part is in a mirror condition.
[Claim 20] The transparence substrate of a pair to which said image display section was joined with the fixed gap in the display according to claim 18, The liquid crystal layer pinched between these transparence substrates, and the pixel electrode group arranged in the shape of [ which is formed at least in one side of the transparence substrate of said pair with a transparent electrode ] a matrix, A polarization selection means for a display to penetrate said 1st linearly polarized light component arranged to the check-by-looking side of this liquid crystal layer, and to absorb said 2nd linearly polarized light component, It is the display which has the polarizing plate arranged to the rear-face side of this liquid crystal layer, and the lighting system further arranged at the tooth back, and is characterized by said change means changing into a dark display condition said liquid crystal layer of the field of said image display member which laps with the field of this mirror condition when said mirror function part is in a mirror condition.
[Claim 21] It is a device equipped with a display. This display Superimposed on the image display section which carries out outgoing radiation of the image light for displaying a desired image, and said image display section, and have been arranged. It has a switchable mirror function part in the image transparency condition which penetrates said image light, and the mirror condition of reflecting outdoor daylight. This mirror function part The reflective mold polarization selection means arranged sequentially from said image display section side, a transparency polarization shaft adjustable means, and an absorption mold polarization selection means are included. Said reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means Are switchable in the condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, and the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said absorption mold polarization selection means It is the device characterized by to carry out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, absorbed said 2nd polarization, said image display section penetrated said 1st polarization, was equipped with a polarization selection means for image light absorb said 2nd polarization, and penetrated said polarization selection means for image light.
[Claim 22] It has the image display section which carries out outgoing radiation of the image light for displaying a desired color picture, and the change function part arranged by superimposing on said image display section. Said change function part The condition of making said image light of

said image display section penetrating outside, and displaying a color picture outside, and in order to change said image display section into a mirror condition Are switchable in the condition of changing the outdoor daylight which carried out incidence to the polarization condition reflected in said image display section. This change function part The transparency polarization shaft adjustable means arranged sequentially from said image display section side and an absorption mold polarization selection means are included. Said transparency polarization shaft adjustable means The condition of making it changing to said 1st polarization and the 2nd polarization which a polarization shaft intersects, and penetrating if polarization of the 1st of the polarization shaft defined beforehand carries out incidence, Are switchable in the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said absorption mold polarization selection means One side is penetrated among said 1st polarization and said 2nd polarization, and another side is absorbed. Said image display section It is the configuration that a field sequential color display method performs color display. Said image display section It is switchable equipment about the image display condition and mirror condition which are characterized by generating said image light of the color of said 1st polarization by penetrating said 1st polarization, having a reflective mold polarization selection means to reflect said 2nd polarization, and making this reflective mold polarization selection means penetrate.

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[Translation done.]

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the device equipped with the mirror with an image display function and this which can change the device equipped with the display with a mirror function and this which can change the display screen to a mirror, or a mirror to an image display screen.
[0002]
[Description of the Prior Art] As a display (or mirror equipped with the display function) switchable in the mirror condition of reflecting outdoor daylight, the display which has arranged the half mirror material in the front face of image display members, such as a liquid crystal display, is known as indicated by JP,11-15392,A, JP,11-291817,A, etc., for example. In these displays, since the outdoor daylight reflected for a half mirror material increases more than the image light which penetrates a half mirror material when it is a lighting system at the putting-out-lights time and an image is a dark display, it will be in a mirror condition. On the other hand, when it is a lighting system at the lighting time and an image is clear display, since the image light which penetrates a half mirror material increases more than the outdoor daylight reflected for a half mirror material, it will be in an image display condition. That is, with these displays, the same observation side is made switchable in a mirror condition and the image display condition by changing the brightness of the image display member on the tooth back of a half mirror material.
[0003] Moreover, the liquid crystal display switchable to the shutter open condition that image display is observed, and the shutter closed state, by which image display is not observed is indicated by the re-official announcement official report of the international public presentation number WO 99/04315. According to this official report, in the case of a shutter closed state, outdoor daylight is reflected and it is indicated that it becomes a "metal tone."
[0004] The liquid crystal display of this re-official announcement official report of WO 99/04315 accumulates two liquid crystal display panels which enclosed the liquid crystal layer with the gap of the substrate of the pair equipped with the electrode, and arranges a polarizing plate to three between the top face of these two accumulated liquid crystal display panels, an inferior surface of tongue, and two liquid crystal display panels. Penetrating the predetermined linearly polarized light as a polarizing plate arranged between liquid crystal display panels among these polarizing plates, the linearly polarized light the linearly polarized light and this and a polarization shaft cross at right angles uses the reflective mold polarizing plate to reflect. The transparency polarization shaft of a reflective mold polarizing plate is used as the transparency polarization shaft of the polarizing plate of the top face of two accumulated liquid crystal display panels at parallel. Moreover, as an upper (observer side) liquid crystal display panel, twist pneumatic mold liquid crystal is used as liquid crystal. With such a configuration, when the electrical potential difference impressed to the liquid crystal layer of an upper liquid crystal display panel is small, since the polarization direction rotates 90 degrees and results in a reflective mold polarizing plate in case a liquid crystal layer is penetrated, the light which penetrated the polarizing plate on top is strongly reflected by the reflection property of a reflective mold polarizing plate. This will be in the shutter closed state of a "metal tone." On the other hand, when the electrical potential difference impressed to the liquid crystal layer of an upper liquid crystal display panel is large, a polarizing plate on top, an upper liquid crystal display panel,

and a reflective mold polarizing plate will be in a transparent condition effectually, and it will be in the shutter open condition that the image display of a lower liquid crystal display panel is observed. That is, the shutter closed state which outdoor daylight is reflected with the mark overvoltage to an upper liquid crystal display panel, and presents a "metal tone", and the shutter open condition that the display of a lower liquid crystal display panel is observed can be changed.

[0005]

[Problem(s) to be Solved by the Invention] Although the above-mentioned conventional display is switchable in the condition like the mirror which reflects outdoor daylight, a condition like this mirror has people inadequate for using it as a mirror which projects and observes its face and figure. This is explained below concretely.

[0006] Since the half mirror is used for the display of above-mentioned JP,11-15392,A or JP,11-291817,A, it depends on the reflection factor of a half mirror for the brightness in the mirror condition of reflecting outdoor daylight. For this reason, in order for people to make it the bright mirror which can be used as a mirror which projects its face and figure, it is necessary to raise the reflection factor of a half mirror. However, if the reflection factor of a half mirror is raised, since the quantity of light of an image falls [ the part of the light reflected for a half mirror material in the case of an image display condition ], a display image will become dark. That is, since the brightness of the image in an image display condition and the brightness of the mirror in a mirror condition have the relation of a trade-off, coexistence of bright image display and a bright mirror is difficult for them. For this reason, it is difficult to raise to the forge fire which can be used as a mirror in which people project their face and figure and observe the brightness of the mirror condition of the display using a half mirror.

[0007] Moreover, in the display using such a half mirror, if it uses under a bright environment, even if it is in an image display condition, a part of outdoor daylight will reflect by the half mirror. For this reason, in an image display condition, degradation of the image quality of the fall of the contrast ratio of the image by reflected [ outdoor daylight ] and reflection of outdoor daylight is produced.

[0008] Moreover, in the display of the re-official announcement official report of the above-mentioned international public presentation number WO 99/04315, when you try to make it function as a mirror in which people project their face and figure and observe the reflex function of outdoor daylight, the following problems are produced.

[0009] In this display, when the electrical potential difference impressed to the liquid crystal layer of an upper (observer side) liquid crystal panel among the liquid crystal panels of two sheets is small, it will be in the shutter closed state of a "metal tone." At this time, a polarizing plate on top is penetrated, the liquid crystal layer of an upper liquid crystal panel is penetrated, it is reflected with a reflective mold polarizing plate, and the light which carried out incidence from the outside returns to the exterior again. This presents reflection like a mirror. Since the transparency polarization shaft and polarization shaft of the above-mentioned reflective mold polarizing plate lie at right angles, it is reflected by this reflective mold polarizing plate, and outgoing radiation of the light which had the condition of polarization controlled as a dark display light on the other hand among the image display light by which outgoing radiation was carried out from the lower liquid crystal panel is not carried out outside. However, since the perfect reflective mold polarizing plate of 100% in the reflection factor of the direction which intersects perpendicularly with a transparency polarization shaft does not exist actually, a part of dark display light penetrates a reflective mold polarizing plate. Since the polarization shaft of dark display light which penetrated the reflective mold polarizing plate corresponds with the transparency polarization shaft of a polarizing plate on top by passing the liquid crystal layer of an upper liquid crystal panel, it penetrates this and is checked by looking by the observer. Namely, optical leakage arises from the dark display of an image outside in the case of a shutter close mirror condition.

[0010] Moreover, since the light which had the polarization condition controlled as a clear display light among the image display light by which outgoing radiation is carried out from a lower liquid crystal panel has the polarization shaft parallel to the transparency polarization shaft of the above-mentioned reflective mold polarizing plate, it penetrates this and passes the liquid crystal layer of an upper liquid crystal panel. Since a polarization shaft rotates 90 degrees in that case, a polarizing plate on top and a polarization shaft cross at right angles, and is absorbed with a polarizing plate on top.

Since the polarization condition of the light by which outgoing radiation is carried out changes in the direction of a liquid-crystal layer of slant with the inclination of the liquid-crystal molecule to the direction of thickness, or conditions of the twist when a liquid-crystal molecule passes light in the direction of thickness and makes it carry out outgoing radiation to a twisting-continuously liquid-crystal layer as generally known, a polarization component parallel to the transparency polarization shaft of a polarizing plate on top is contained in the light by which outgoing radiation is carried out in the direction of slant. For this reason, rather than the direction of a transverse plane of a display, from across, the optical leakage of many will arise and it will be checked by looking by the observer.

[0011] Artificers actually create the display of the re-official announcement official report of the international public presentation number WO 99/04315, and the almost same display, and the result of having measured the leakage of the light in a shutter closed state is shown in drawing 44 . The graph of drawing 44 is data which were made to carry out image display with a lower liquid crystal panel so that brightness 450 cd/m2 may be obtained in the clear display section when image display of the display was carried out in the state of shutter open, and measured the optical leakage from the front face of a display by making an upper liquid crystal panel into a shutter closed state in the condition. The axis of abscissa of drawing 44 shows the location on the display of a display, and an axis of ordinate shows the brightness value in the direction of a transverse plane.

[0012] Like drawing 44 , the optical leakage of the direction of a transverse plane of a dark display was the brightness value 24 - 28 cd/m2, and the optical leakage of the direction of a transverse plane of the clear display section was the brightness value 4 - 5 cd/m2. Therefore, the dark display of the optical leakage of the direction of a transverse plane was about 7 times as larger as the clear display section. Moreover, the leakage of the light in a dark display is uneven to a location, and the irregular color was also accepted. In addition, if the value of the brightness value 4 - 5 cd/m2 is under a gloomy environment, it is a value which can fully be checked by looking. Moreover, when it observed from across, depending on the direction, the leakage of two or more 4 - 5 cd/m light was observed from the clear display section. Thus, if it is going to operate the shutter closed state of the conventional display as a mirror, the contrast ratio of a reflected image will decrease remarkably for the leakage of light. For this reason, as a mirror which projects people's face and figure, it is not enough.

[0013] In addition, the birefringence reflective mold polarization film which carried out two or more layer laminating of the different form birefringence high polymer film currently indicated by international public presentation number:WO 95/No. 27919 of international application by turns as a reflective mold polarizing plate can be used. Such a reflective mold polarizing plate is usually arranged between the polarizing plates and lighting systems (back light) which are arranged to the rear-face side of a liquid crystal device, and when using the use effectiveness of the illumination light for the improving purpose, very high effectiveness is acquired. However, since the leakage of the light to predetermined polarization poses a big problem in realizing mirror engine performance which this invention makes the purpose, sufficient mirror engine performance cannot be obtained only with such a reflective mold polarizing plate.

[0014] This invention aims at offering switchable equipment in the condition of displaying a high definition image, and the mirror condition that the legible reflected image suitable for people projecting and observing their face and figure is acquired.

[0015]

[Means for Solving the Problem] According to this invention, switchable equipment is provided with the image display condition and mirror condition of the following configurations in order to attain the above-mentioned purpose.

[0016] Namely, the image display section which carries out outgoing radiation of the image light for displaying a desired image, It has a switchable mirror function part in the image transparency condition which has been arranged by superimposing on said image display section and which penetrates said image light, and the mirror condition of reflecting outdoor daylight. This mirror function part The reflective mold polarization selection means arranged sequentially from said image display section side, a transparency polarization shaft adjustable means, and an absorption mold polarization selection means are included. Said reflective mold polarization selection means

Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means Are switchable in the condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, and the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said absorption mold polarization selection means One side is penetrated among said 1st polarization and the 2nd polarization, and another side is absorbed. Said image display section It is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.

[0017]

[Embodiment of the Invention] With the gestalt of this operation, equipment (namely, a display with a mirror function or a mirror with a display function) with switchable image display condition and mirror condition is offered. In the state of a mirror, this equipment prevents the optical leakage of image display light, is bright and can acquire the high reflected image of a contrast ratio. Therefore, the equipment of the gestalt of this operation is suitable for in the case of a mirror condition, people projecting their face and figure and observing. It is thought that how whose face of people is visible is generally dependent on physical quantity, such as magnitude of a part, a brightness value, and a contrast ratio (luminance contrast). It is checked by evaluation experiment that evaluation of the ease of being visible is so high that a contrast ratio (luminance contrast) is large (the Okuda ****, Ryuuji Sato: the basic examination about construction of the appraisal method to how whose face of people is visible, the Illuminating Engineering Institute of Japan, the 84th volume, No. 11, pp 809-814). Moreover, in the state of image display, even if the equipment of the gestalt of this operation is under a bright environment, there is little degradation of image quality, such as reflected [ outdoor daylight ] and a fall of a contrast ratio, and a bright image is obtained.

[0018] Hereafter, the display with a change function to the mirror condition of the gestalt of operation of this invention is explained with reference to drawing 1 - drawing 6 .

[0019] First, the basic configuration and actuation of the display with a change function to the mirror condition of the gestalt of the 1st operation are explained using drawing 1 and drawing 2 .

[0020] The display of the mode of the 1st operation has the image display section 1000 arranged in order, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 like drawing 1 . The image display section 1000 penetrates the linearly polarized light component of the direction defined beforehand, and this absorption mold polarization selection member 208 is arranged at the reflective mold polarization selection member 300 side including the absorption mold polarization selection member 208 which absorbs the linearly polarized light component of the direction which intersects perpendicularly with it. With the gestalt of this operation, the image display section 1000 contains a lighting system, a liquid crystal layer, and the absorption mold polarization selection member of two sheets whose liquid crystal layer is pinched. An outgoing radiation side thing is the absorption mold polarization selection member 208 among the absorption mold polarization selection members of two sheets. The electrical potential difference impressed to a liquid crystal layer is changed by the clear display field and the dark viewing area, from a clear display field, outgoing radiation of the linearly polarized light which penetrates the absorption mold polarization selection member 208 is carried out, by the dark viewing area, light is made to absorb by the absorption mold polarization selection member 208, and outgoing radiation of the light is not carried out. Thereby, it is the configuration which displays an image. Therefore, the image light (clear display light) by which outgoing radiation is carried out from the image display section 1000 is the linearly polarized light which has the polarization shaft which was in agreement with the transparency polarization shaft of the absorption mold polarization selection member 208. The linearly polarized light which has the polarization shaft of the same direction as the polarization shaft of image light hereafter is called "the 1st linearly polarized light." Moreover, the linearly polarized light of the direction where the 1st linearly polarized light and polarization shaft intersect perpendicularly is called "the 2nd linearly polarized light."

[0021] The reflective mold polarization selection member 300 is a member which reflects the linearly polarized light component which penetrates the linearly polarized light component of the direction defined beforehand, and intersects perpendicularly with it. Here, the reflective mold polarization selection member 300 penetrated the 1st linearly polarized light component, and arranges the 2nd linearly polarized light component to the sense to reflect.

[0022] In case the linearly polarized light light which carried out incidence penetrates the transparency polarization shaft variant part 400, it is a component which has the structure which can choose the condition of changing the polarization shaft, and the condition of not changing a polarization shaft, by electric change. With the gestalt of this operation, the liquid crystal device which contains the liquid crystal layer 407 and the transparent electrodes 403 and 406 for impressing an electrical potential difference to the liquid crystal layer 407 as a transparency polarization shaft variant part 400 is used. The changeover switch 813 which changes turning on and off of an electrical potential difference is connected to the transparent electrode 403. While turning OFF the electrical potential difference impressed to the liquid crystal layer 407 with the changeover switch 813, the liquid crystal layer 407 is in the condition of changing the polarization shaft of the linearly polarized light which carried out incidence, and if an electrical potential difference is turned ON, it will be in the condition of not changing a polarization shaft. With the gestalt of this operation, the liquid crystal layer 407 is the so-called twist pneumatic (TN) mold liquid crystal constituted so that 90 degrees might be continuously twisted between a transparent electrode 403 and a transparent electrode 406 at the time of electrical-potential-difference OFF of the major axis of liquid crystal molecule 407a. The direction of orientation of the liquid crystal layer 407 has defined the 1st linearly polarized light which carried out incidence from the reflective mold polarization selection member 300 side in the direction changed to the 2nd linearly polarized light. On the other hand, in electrical-potential-difference ON, liquid crystal molecule 407a of the liquid crystal layer 407 will be in the condition of having stood perpendicularly to transparent electrodes 403 and 406 like drawing 2 , and will be in the condition of not changing the polarization shaft of the light which carried out incidence.

[0023] The absorption mold polarization selection member 500 is a member which absorbs the linearly polarized light component of the direction which penetrates the linearly polarized light component of the direction defined beforehand, and intersects perpendicularly with it. Here, the absorption mold polarization selection member 500 absorbs the linearly polarized light component of [ 1st ] the light which carried out incidence, and the 2nd linearly polarized light component is arranged so that it may penetrate.

[0024] In addition, an observer will observe this display from the absorption mold polarization selection member 500 side (space left-hand side in drawing 1 ).

[0025] Below, actuation of the display of the gestalt of the 1st operation is explained using drawing 1 and drawing 2 .

[0026] In using the indicating equipment of the gestalt of this operation in the state of image display, like drawing 1 , a changeover switch 813 is turned OFF and it sets it as the condition that 90 degrees liquid crystal molecule 407a of the liquid crystal layer 407 of the transparency polarization shaft variant part 400 was twisted. In this condition, outgoing radiation of the image light (clear display light) 3001 of a desired display is carried out from the image display section 1000. Since the image light 3001 is a light which has passed the absorption mold polarization selection member 208 of the image display section 1000, it is the 1st linearly polarized light. Therefore, the polarization shaft of the image light 3001 is in agreement with the transparency polarization shaft of the reflective mold polarization selection member 300, penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400. As mentioned above, since the liquid crystal layer 407 of the transparency polarization shaft variant part 400 is set as the OFF state, the polarization shaft rotates along with the torsion of liquid crystal molecule 407a, the image light 3001 of the 1st linearly polarized light which carried out incidence turns into the 2nd linearly polarized light, and outgoing radiation is carried out. Since the polarization shaft of image light 3001 used as the 2nd linearly polarized light corresponds with the transparency polarization shaft of the absorption mold polarization selection member 500, it penetrates this and is observed by the observer.

[0027] On the other hand, although it is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed and, as for the outdoor daylight 3002 which carries out incidence from an observer side to a display in an image display condition, only the 2nd linearly polarized light component penetrates it. In case the outdoor daylight 3002 of the 2nd linearly polarized light which penetrated the absorption mold polarization selection member 500 penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light to the 1st linearly polarized light. Thereby, since a polarization shaft is in agreement with the transparency polarization shaft of the reflective mold polarization selection member 300, it penetrates without being reflected by the reflective mold polarization selection member, and incidence is carried out to the image display section 1000. Since the polarization shaft of outdoor daylight 3002 of the 1st linearly polarized light which carried out incidence corresponds with the transparency polarization shaft of the absorption mold polarization selection member 208, it penetrates the absorption mold polarization selection member 208, and it carries out incidence to the liquid crystal layer of the image display section 1000. At this time, the light which carried out incidence to the dark viewing area is absorbed by the absorption mold polarization selection member arranged rather than the liquid crystal layer at the lighting-system side. Therefore, it does not return to an observer side. Moreover, the light which carried out incidence to the clear display field also penetrates the absorption mold polarization selection member by the side of the light source, and results in a lighting system. Although a part of light which resulted in the lighting system is reflected by this, the reflected light is substantially [ as the illumination light ] unchanging, and since it becomes a part of illumination light, reflection of the outdoor daylight which degrades image quality does not become. That is, even if outdoor daylight carries out incidence in an image display condition in the display of the gestalt of this operation, there is almost no reflection of the outdoor daylight which degrades image quality.

[0028] Thus, since the display of the gestalt of this operation turns on an observer in the state of image display, without the image light 3001 losing almost, a bright image is obtained. On the other hand, since it is hardly reflected in a display, outdoor daylight 3002 does not almost have degradation of the image quality by reflection of outdoor daylight, such as reflected and a fall of a contrast ratio.

[0029] The case where the display of the gestalt of this operation is used for the next in the mirror condition, changing it is explained. In this case, like drawing 2 , a changeover switch 813 is turned ON and it is set as the condition of having made liquid crystal molecule 407a of the liquid crystal layer 407 of the transparency polarization shaft variant part 400 standing.

[0030] Although the outdoor daylight 3002 which faces to this display from an observer side at this time is unpolarized light, in case it penetrates the absorption mold polarization selection member 500, the 1st linearly polarized light component is absorbed, only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. Since the transparency polarization shaft variant part 400 is in the condition liquid crystal molecule 407a of the liquid crystal layer 407 stood, the outdoor daylight 3002 which carried out incidence penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization condition changing, and results in the reflective mold polarization selection member 300. Since the reflective polarization shaft of the reflective mold polarization selection member 300 is in agreement with the polarization shaft of the 2nd linearly polarized light, outdoor daylight 3002 is reflected by the reflective mold polarization selection member 300. It carries out incidence to the transparency polarization shaft variant part 400 again, the outdoor daylight 3002 reflected by the reflective mold polarization selection member 300 penetrates this with the 2nd linearly polarized light, outgoing radiation of it is carried out, also penetrates the absorption mold polarization selection member 400 further, and turns on an observer. Thereby, the reflected image of outdoor daylight 3002 is acquired and a mirror condition is realized.

[0031] Since the image light (clear display light) 3001 by which outgoing radiation is carried out from the image display section 1000 in this mirror condition is the 1st linearly polarized light which penetrated the absorption mold polarization selection member 208, it penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400. Since the transparency polarization shaft variant part 400 is an ON state, the polarization condition of the image light 3001 penetrates this with the 1st linearly polarized light, without changing, and it carries out incidence to the absorption mold polarization selection member 500. Since the 1st linearly polarized light is in agreement with the absorption polarization shaft of the absorption mold polarization selection member 500, it is absorbed by the absorption mold polarization selection member 500, and is not observed by the observer.

[0032] That is, ideally, since the light of the one half of unpolarized light reflects by the reflective mold polarization selection member 300 and goes to an observer side, the outdoor daylight 3002 which the light from an image display member does not result at an observer in the case of a mirror condition, and carries out incidence to a display from a perimeter on the other hand functions as a bright mirror.

[0033] In addition, in the case of a mirror condition, the display of the gestalt of this operation can decrease optical leakage sharply as compared with the display of the re-official announcement official report of the international public presentation number WO 99/04315. Although the optical leakage from the dark display which originates in the reflective engine performance of a reflective mold polarizing plate in a mirror condition was a problem by the international public presentation number WO 99/04315, since the image display section 1000 is equipped with the absorption mold polarization selection member 208 and is absorbing the illumination light of a dark viewing area in the display of the gestalt of this operation, light does not reach the reflective mold polarization selection member 300 by the dark viewing area. For this reason, most optical leakage from a dark viewing area is not observed regardless of the engine performance of the reflective mold polarization selection member 300.

[0034] Moreover, the display of the gestalt of this operation is a configuration which turns ON the transparency polarization shaft variant part 400, and makes liquid crystal molecule 407a stand in a mirror condition. Generally the gap of the polarization shaft of light made to carry out outgoing radiation in the direction of slant is smaller than the time of being in the condition in which the liquid crystal molecule of electrical-potential-difference OFF of the direction of the condition that pneumatic mold liquid crystal made the liquid crystal molecule of electrical-potential-difference ON stand was twisted. For this reason, as compared with the thing of a configuration of making the display of the gestalt of this operation electrical-potential-difference OFF in the state of the mirror stated by the Prior art, the effectiveness that there is little optical leakage by the direction of slant of the image light (clear display light) 3001 is also acquired in a mirror condition.

[0035] The leakage of the light from the image display section 1000 in a mirror condition is concretely explained using the graph of drawing 3 and drawing 4 . Drawing 3 expresses the size of the leakage of the light in a dark viewing area by the clear display field and drawing 4 with the brightness value. These graphs are data in the case of performing clear display of brightness 450 cd/m2, when an indicating equipment is in an image display condition, an axis of abscissa shows the location on the display of an indicating equipment, and an axis of ordinate shows the brightness value in a perpendicular direction to the direction of a transverse plane, i.e., a screen. Moreover, each optical leakage of a configuration of having used A type polarizing plate, B type polarizing plate, and C type polarizing plate as an absorption mold polarization selection member 208 of the image display section 1000 and the optical leakage of the equipment which removed the image display section 1000 to the absorption mold polarization selection member 208, and made other configurations be the same as that of the display of the gestalt of this operation were shown in drawing 3 and drawing 4 . In addition, even if it was the configuration which removed the absorption mold polarization selection member 208, in the state of image display, the image of level has usually been displayed. Moreover, the detail of A, B, and C type polarizing plate is mentioned later.

[0036] In the clear display field in a mirror condition, the leakage of light is suppressed by one half extent rather than the equipment in which the absorption mold polarization selection member 208 does not have the direction of the display of the gestalt of this operation which uses the absorption mold polarization selection member 208 as shown in drawing 3 . For this reason, the display of the gestalt of this operation can realize the mirror in which a contrast ratio projects a high reflected image. Moreover, in the dark viewing-area section in a mirror condition, since the display of the gestalt of this operation using the absorption mold polarization selection member 208 does not have the leakage of light **********, implementation can do the mirror in which a contrast ratio projects a legible higher reflected image, as shown in drawing 4 . On the other hand, with the display which does not use the absorption mold polarization selection member 208, the optical leakage of many has arisen in the dark viewing area like drawing 4 .

[0037] From these things, the display of the gestalt of this operation shows that a mirror with more sufficient visibility is realizable by indicating the image display section 1000 to a dark display in a mirror condition. As for this, the conventional display in which optical leakage was shown by the display and drawing 44 of a configuration of not having the absorption mold polarization selection member (polarizing plate) 208 which showed optical leakage by drawing 3 and drawing 4 is contrastive with there being leakage of light than the clear display section as for more dark displays.

[0038] Therefore, with the gestalt of this operation, in making the whole screen surface into a mirror condition, it makes the lighting system of a dark display or the image display section 1000 itself into a nonluminescent condition for the image display section 1000 whole. Moreover, in [ of the transparency polarization shaft variant part 400 ] making some screens into a mirror condition by making only a field into an electrical-potential-difference ON state in part, it makes into a dark display or a nonluminescent condition the image display section 1000 of the field made into a mirror condition, and the field with which it laps. Thereby, the optical leakage from the part of a mirror condition can be decreased, and the reflected image of a high contrast ratio can be projected.

[0039] If a changeover switch 813 is specifically changed to ON in order to change to a mirror condition, it can be made the configuration which prepares the circuit which the circuit which is interlocked with a changeover switch 813 and makes a dark display the liquid crystal device of the image display section 1000 is prepared [ circuit ], or makes the lighting system of the tooth back of the liquid crystal device of the image display section 1000 switch off. When it is made to make a lighting system switch off in the case of a mirror condition, reduction of the power consumption of a display is attained. In addition, since the display of an image display field will become dark if the lighting system of the tooth back of a liquid crystal device is switched off in making some screens into a mirror condition and displaying an image on the remaining part, it is desirable to consider the image display section 1000 of the field made into a mirror condition and the field with which it laps as a dark display. thereby -- high -- it becomes possible implementation of the mirror condition of realizing a contrast ratio reflected image, and to realize bright image display on the same screen at coincidence.

[0040] Moreover, as the image display section 1000, although a liquid crystal device is used, a spontaneous light type display like an others and organic electroluminescence (EL:electroluminescence) component can also be used. It considers as the configuration which equips the reflective mold polarization selection member 300 of an EL element, and the location which counters with the absorption mold polarization selection member 208. When using an EL element, the leakage of light can be theoretically abolished by making it a change in the mirror condition interlocked with, stopping the luminescence of an EL element itself, and changing into a dark display condition. While the high-definition mirror condition that the reflected image of a high contrast ratio is acquired is realizable by this, reduction of the power consumption of a display is attained.

[0041] Moreover, the display of the gestalt of this operation can be used as a projection mold display by combining a liquid crystal device for this, using discharge lamps, such as a metal halide lamp, as the light source of the lighting system of the image display section 1000. In this case, since a discharge lamp cannot perform lighting and putting out lights quickly, it is desirable to make it the configuration which reduces optical leakage by making it a change in the mirror condition interlocked with, and indicating the image display section 1000 to a dark display.

[0042] In addition, although a transparency polarization shaft is parallel to the polarization shaft of the 1st linearly polarized light as an absorption mold polarization selection member 500 like drawing 1 and drawing 2 and the absorption polarization shaft used the thing parallel to the polarization shaft of the 2nd linearly polarized light with the gestalt of the 1st operation This invention is not limited to this, its transparency polarization shaft is parallel to the polarization shaft of the 2nd linearly polarized light, and an absorption polarization shaft can use a thing parallel to the polarization shaft of the 1st linearly polarized light. In this case, it becomes the configuration which changes a display

to a mirror condition by changing a display to an image transparency condition and changing the transparency polarization shaft variant part 400 for the 1st polarization to the condition (electrical potential difference off condition) make it change to the 2nd polarization by changing to the condition (condition of electrical-potential-difference ON) penetrate without changing the polarization shaft which carried out incidence of the transparency polarization shaft variant part 400.
[0043] Next, a basic configuration and actuation are explained using drawing 5 and drawing 6 about the display with a change function to the mirror condition of the gestalt of operation of the 2nd of this invention.
[0044] The display of the gestalt of the 2nd operation transposes the absorption mold polarization selection member 500 of drawing 1 of the gestalt of the 1st operation, and the display of drawing 2 to the combination of the reflective mold polarization selection member 301 and the adjustable polarization selection member 600. Since other configurations are the same as that of the display of the gestalt of the 1st operation, the same sign is attached to the same section and detailed explanation is omitted.
[0045] The reflective mold polarization selection member 301 is arranged in the location which counters the transparency polarization shaft variant part 400, and the adjustable polarization selection member 600 is arranged rather than the reflective mold polarization selection member 301 at the observer side. The reflective mold polarization selection member 301 reflects the 1st linearly polarized light component, and the 2nd linearly polarized light component is a configuration to penetrate. The adjustable polarization selection member 600 absorbs the linearly polarized light component of [ 1st ] the light which carried out incidence, and the 2nd linearly polarized light component is a selectable configuration about either of the condition of penetrating, and the condition of penetrating all polarization components.
[0046] The display of the gestalt of the 2nd operation is considered as the configuration changed by control of the polarization condition by the transparency polarization shaft variant part 400, and absorption of the polarization by the adjustable polarization selection member 600 or control of transparency in an image display condition and a mirror condition. In addition, an observer observes a display from the adjustable polarization selection member 600 side.
[0047] Here, what contains the transparent electrodes 603 and 606 which impress an electrical potential difference to the liquid crystal layer 607 and the solution layer layer 607 of a guest host mold, and changeover switch 600a as an adjustable polarization selection member 600 is used. When changeover switch 600a is OFF, orientation of the liquid crystal layer 607 is carried out so that the major axis of liquid crystal molecule 607a of the liquid crystal layer 607 may become the 1st linearly polarized light and parallel like drawing 5 . Thereby, in an OFF state, the adjustable polarization selection member 600 absorbs the 1st linearly polarized light component, and penetrates the 2nd linearly polarized light component the 2nd and this and a polarization shaft cross at right angles. Moreover, since liquid crystal molecule 607a becomes perpendicular to a transparent electrode 603,606 like drawing 6 when changeover switch 600a is ON, the adjustable polarization selection member 600 penetrates all polarization components.
[0048] Actuation in case the display of the gestalt of the 2nd operation is in an image display condition is explained using drawing 5 . When changing into an image display condition, while turning OFF a changeover switch 813 and making the transparency polarization shaft variant part 400 into an OFF state, it is made for this to be interlocked with, and changeover switch 600a is also turned OFF and makes the adjustable polarization selection member 600 an OFF state.
[0049] The image light 3001 which carried out outgoing radiation from the image display section 1000 penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400. At this time, since the transparency polarization shaft variant part 400 is an OFF state, the passing image light 3001 changes from the 1st linearly polarized light to the 2nd linearly polarized light. Since the image light 3001 which penetrated the transparency polarization shaft variant part 400 is the 2nd linearly polarized light, its polarization shaft corresponds with the transparency polarization shaft of the reflective mold polarization selection member 301, and it penetrates this. Furthermore, since it is in agreement also with the transparency polarization shaft of the adjustable polarization selection member 600 of an OFF state, this is also penetrated and it is observed by the observer.

[0050] On the other hand, although the outdoor daylight 3002 which carries out incidence from an observer side to the display of an image display condition is unpolarized light, only the 2nd linearly polarized light component it the 1st linearly polarized light component which is in agreement with the absorption polarization shaft of an adjustable polarization selection member is absorbed, and corresponds with a transparency polarization shaft since the adjustable polarization selection member 600 is an OFF state penetrates. In case the outdoor daylight 3002 of the 2nd linearly polarized light which penetrated the adjustable polarization selection member 600 penetrates the reflective mold polarization selection member 301 and penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the 1st reflective mold polarization selection member 300, and it carries out incidence to the liquid crystal layer of the image display section 1000. At this time, as the gestalt of the 1st operation explained, the light which carried out incidence to the dark viewing area is absorbed by the absorption mold polarization selection member arranged rather than the liquid crystal layer at the lighting-system side. Therefore, it does not return to an observer side. Moreover, although the light which carried out incidence to the clear display field also penetrates the absorption mold polarization selection member by the side of the light source, and results in a lighting system and a part is reflected, the reflected light is substantially [ as the illumination light ] unchanging, and turns into a part of illumination light. That is, even if outdoor daylight carries out incidence in an image display condition in the display of the gestalt of this operation, there is almost no reflection of the outdoor daylight which degrades image quality.

[0051] Therefore, in the state of image display, since the image light 3001 turns on an observer, without losing almost, a bright image is obtained. Moreover, since it is hardly reflected with a display, outdoor daylight 3002 does not produce image quality degradation, such as reflected [ outdoor daylight ] or a fall of a contrast ratio.

[0052] Below, the actuation is explained about the case where the display of the gestalt of the 2nd operation is in a mirror condition, using drawing 6 . In the case of a mirror condition, a changeover switch 813 and changeover switch 600a are interlocked, turn ON, and let the transparency polarization shaft variant part 400 and the adjustable polarization selection member 600 be ON states.

[0053] In the case of a mirror condition, all polarization components penetrate the adjustable polarization selection member 600 like drawing 6 in the outdoor daylight 3002 which carried out incidence from the observer side to the display. Incidence of the outdoor daylight 3002 which penetrated the adjustable polarization selection member 600 is carried out to the reflective mold polarization selection member 301. The 2nd linearly polarized light component penetrates the reflective mold polarization selection member 301 among the outdoor daylight 3002 which carried out incidence to the reflective mold polarization selection member 301, and it is reflected by the reflective mold polarization selection member 301, and the 1st linearly polarized light component penetrates the adjustable polarization selection member 600 again, and goes to an observer side. On the other hand, the transparency polarization shaft variant part 400 is penetrated without a polarization shaft changing, it is reflected by the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the reflective mold polarization selection member 301 and the adjustable polarization selection member 600 are penetrated again, and the 2nd linearly polarized light component which penetrated the reflective mold polarization selection member 301 is the other side to an observer side.

[0054] Thus, as for the outdoor daylight 3002 which carried out incidence, almost all the polarization component is reflected by the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 in the display of the gestalt of the 2nd operation. Therefore, the mirror condition that a very bright reflected image is acquired is acquired.

[0055] On the other hand, since the image light (clear display light) 3001 which carried out outgoing radiation from the image display section 1000 in the case of the mirror condition has passed the absorption mold polarization selection member 208 as the gestalt of the 1st operation explained, it is the 1st linearly polarized light. Therefore, since the transparency polarization shaft variant part 400 is penetrated with the 1st linearly polarized light, without a polarization shaft changing, it is reflected by the reflective mold polarization selection member 301 and the image light 3001 returns to the image display section 1000 after penetrating the reflective mold polarization selection member 300, it is hardly observed by the observer.

[0056] In addition, in order to reduce more the leakage of the light from the image display section 1000 side in a mirror condition, as the gestalt of the 1st operation described, it is desirable to consider the viewing area of the image display section 1000 equivalent to the field which is in the mirror condition as a dark display. When making the whole viewing area into a mirror field, the leakage of light can be abolished by changing the lighting system of the image display section into a nonluminescent condition.

[0057] Thus, in the display of the gestalt of the 2nd operation, since [ of outdoor daylight 3002 ] a polarization component is almost reflected, while a very bright reflected image is acquired, there is little optical leakage of the image light 3001 in a mirror condition, and a legible mirror is obtained at it. Moreover, like the gestalt of the 1st operation, in the case of an image display condition, there is little reflected **** of outdoor daylight, and it can display a bright image on it.

[0058] In addition, although a reflective polarization shaft is parallel to the polarization shaft of the 1st linearly polarized light like drawing 5 and drawing 6 as 2nd reflective mold polarization selection member 301 and the transparency polarization shaft used the thing parallel to the polarization shaft of the 2nd linearly polarized light with the gestalt of the 2nd operation This invention is not restricted to this configuration, its reflective polarization shaft is parallel to the polarization shaft of the 2nd linearly polarized light, and a transparency polarization shaft can use a thing parallel to the polarization shaft of the 1st linearly polarized light. In this case, while changing to the condition (electrical-potential-difference ON state) of penetrating without changing the polarization shaft which carried out incidence of the transparency polarization shaft variant part 400 By changing to the condition (electrical-potential-difference OFF state) of absorbing the 2nd linearly polarized light for the adjustable polarization selection section 600, and penetrating the 1st linearly polarized light Change a display to an image transparency condition, and while changing the 1st linearly polarized light to the condition (electrical-potential-difference OFF state) of making it changing to the 2nd linearly polarized light, the transparency polarization shaft variant part 400 A display can be made the configuration changed to a mirror condition by changing the adjustable polarization selection section 600 to the condition (electrical-potential-difference ON state) of penetrating all polarization components.

[0059] In addition, although the liquid crystal device of the transparency mold containing a lighting system was explained with the gestalt of the above-mentioned 1st and the 2nd operation when a liquid crystal device was used as the image display section 1000, it is also possible to use the liquid crystal device of a reflective mold.

[0060] Moreover, when the degree of polarization of P1 and the absorption mold polarization selection member 500 is set to P2 for the degree of polarization of the absorption mold polarization selection member 208 which constitutes an image display member, it is desirable to fill the relation of 0.966 <=P1 <=0.995 <=P2, or to fill the relation of 0.966 <=P2 <=0.995 <=P1. The below-mentioned example 2 explains this reason.

[0061] Moreover, in the display of the gestalt of the 1st and the 2nd operation, it is desirable to form an antireflection film in the front face of the absorption mold polarization selection members 500 and 208 and the outermost surface of the adjustable polarization selection member 600.

[0062] Moreover, it is desirable to set spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 to 0.11mm or less in this invention. The below-mentioned example 2 explains this reason.

[0063] Moreover, it is desirable to constitute from this invention so that the 58.6mmx39.1mm field whole region may serve as a mirror substantially at least when a display is changed into a mirror condition. This is the magnitude defined in consideration of projecting the quadrant of an adult male's face. The below-mentioned example also explains this.

[0064] Moreover, in the gestalt of the 1st and the 2nd operation, a film-like member can be used as a reflective mold polarization selection member 300,301. In this case, it is desirable for rigidity to be high, and for it to be flat and transparent, and to adhere to a **** transparence [ target / optical ] substrate directly through a transparent binder, or to carry out adhesion immobilization indirectly through a flat film etc., and to constitute a film-like member so that there may be no distortion in a reflector.

[0065] Moreover, the display of the gestalt of the 1st and the 2nd operation can be used as the display of the projection method with which the incident light which carried out outgoing radiation is irradiated by the transparency mold screen through a mirror member from a projection device. In this case, it is good also as a configuration which equips a transparency mold screen with a mirror function part. In this case, a projection device is constituted so that outgoing radiation of the linearly polarized light whose polarization condition of each colored light corresponded as incident light shall be carried out and this linearly polarized light light may turn into s-polarized light light or p-polarized light light to the reflector of a mirror member further.

[0066] Among the mirror function part which constitutes said transparency mold screen, and optical system, by making a mirror function part into removable structure, when a mirror function is unnecessary, it can consider as the configuration which removes a mirror function part further again. Or it is good also as a configuration which constitutes the screen equipped with the mirror function part independently excluding the image display section, and equips the display of arbitration with this mirror functional screen if needed.

[0067] the gestalt of the 1st and the 2nd operation -- setting -- as the reflective mold polarization selection member 300,301 -- 1000 -- a metal conductive in the pitch of hundreds of A (ten to 10 m) -- a line -- the configuration which has arranged the pattern -- it can use . At this time, the longitudinal direction of a metal wire-like pattern serves as a reflective polarization shaft. moreover, a transparence substrate top -- 1000 -- a metal conductive in the pitch of hundreds of A (ten to 10 m) -- a line -- the line which forms a pattern and adjoins each other further -- it is what connected some patterns electrically, and a transparent electrode and a reflective mold polarization selection member can be made to make it serve a double purpose Thereby, a transparent electrode 606, the reflective mold polarization selection member 301 or the reflective mold polarization selection member 301, a transparent electrode 403 or a transparent electrode 406, and the reflective mold polarization selection member 300 can be constituted.

[0068] The image display member 1000 can be made into the following structures in the gestalt of the above 1st and the 2nd implementation. Namely, the transparence substrate of a pair joined with the fixed gap and the liquid crystal layer pinched between these transparence substrates, The pixel electrode group arranged in the shape of [ which is formed at least in one side of the transparence substrate of said pair with a transparent electrode ] a matrix, The liquid crystal device containing the absorption mold polarization selection member by which the absorption mold polarization selection member 208 arranged at an observer side and an observer side are arranged at the transparence substrate of the opposite side, It can consider as the configuration equipped with the lighting system arranged at the tooth back of the liquid crystal device mechanical component for a display which impresses the electrical potential difference corresponding to a picture signal to said pixel electrode group, and said liquid crystal device for a display. At this time, it can be made a configuration equipped with the change section which lighting of a lighting system and putting out lights are interlocked with a changeover switch 813, and changes them. A lighting system has the light source which carries out sequential luminescence of two or more colored light, and a liquid crystal device can be considered as the configuration which performs field sequential color display corresponding to the colored light from a lighting system.

[0069] Moreover, it can also consider as the configuration using a reflective mold liquid crystal device as the image display section 1000. In this case, as a reflective mold liquid crystal device, the seal of the perimeter can be carried out for a transparence substrate and a reflective substrate equipped with the reflective section by the sealant of the shape of lamination and a frame through spacers, such as a bead, and what enclosed and closed liquid crystal in the gap of said two substrates can be used. At this time, the laminating of the phase contrast plate is carried out to a transparence substrate, and it is arranged to it. In addition, a transparence substrate or a reflective substrate can be equipped with a color filter. As for this color filter, it is desirable to have the function which raises the darkness in a dark display, and it is more desirable to specifically use the color filter of a delta array.

[0070] Moreover, in the display of the gestalt of the 1st and the 2nd operation, it can constitute so that the image display area size in the field and image display condition which will be in a mirror condition may differ. Moreover, as the image display section 1000, it can function as a transparency mold by some viewing areas, and the thing of a configuration of having the liquid crystal device for a display which functions as a reflective mold, and a lighting system for illuminating the field which functions as said transparency mold can be used in the other field.

[0071] Moreover, in the display of the gestalt of the 1st and the 2nd operation, it is good also as a configuration which divides the viewing area of the image display section into plurality to a field, and performs change control with a mirror condition and an image display condition for every division field. In order to realize this, the light transmission side of the transparency polarization shaft variant part 400 or the adjustable polarization selection member 600 can be divided into two or more fields, and it can be made the configuration which performs the selection control in the condition of not changing with the condition of changing the polarization shaft of the light penetrated for every individual field, and the selection control of polarization light which should be absorbed.

[0072]

[Example] Hereafter, the example of this invention is explained.

[0073] (Example 1) The display with a change function to the mirror condition of the example 1 of this invention is explained using drawing 7 and drawing 8 . The basic configuration of the display of this example 1 is the same as that of the display shown in drawing 1 of the gestalt of the 1st operation, and drawing 2 .

[0074] The display of drawing 7 of an example 1 has the image display section 1000 piled up in order, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 like the gestalt of the 1st operation. These are held in the case 1070 which has opening 1071. Opening 1071 serves as the image display section switchable in the mirror condition. An operation of each part is as the gestalt of the 1st operation having explained.

[0075] The image display section 1000 has the liquid crystal display panel 200 which displays an image by adjusting the amount of transmitted lights of light, and the lighting system 100 arranged at the tooth back including the liquid crystal device for a display, as shown in drawing 7 and drawing 8 . It is desirable to use the liquid crystal display panel using display modes, such as TN (Twisted Nematic) mode, STN (Super Twisted Nematic) mode, and ECB (Electrically Controlled Birefringence) mode, as a liquid crystal display panel 200. In order that such a liquid crystal display panel may display in modulating the polarization condition of the light which carries out incidence to a liquid crystal layer using a polarizing plate, a high contrast ratio is obtained by comparatively low driver voltage. Moreover, linearly polarized light light carries out outgoing radiation as an image light with the polarizing plate which functions as an absorption mold polarization selection member 208 arranged at the reflective mold polarization selection member 300 side of the liquid crystal display panel 200.

[0076] In addition, the liquid crystal display panel 200 has two methods of the liquid crystal display panel by the active-matrix drive using switching elements, such as TFT (Thin Film Transistor), and the liquid crystal display panel of a multiplexer drive, can choose either and can be used as generally known. Specifically, liquid crystal display panels of a multiplexer drive, such as a liquid crystal display panel by the active-matrix drive of TN (Twisted Nematic) liquid crystal display panel, an IPS (In Plane Switching) liquid crystal display panel, a MVA (Multi-domain Vertical Aligned) liquid crystal display panel, etc., etc. or a STN (Super Twisted Nematic) liquid crystal display panel, can be used. Although an example 1 explains the case where TN liquid crystal display panel is used as a liquid crystal display panel 200, this invention is not limited to this.

[0077] The detailed configuration of each part of the display of an example 1 is explained using drawing 8 .

[0078] What can illuminate the image display section of the liquid crystal display panel 200 to homogeneity is used for a lighting system 100. Generally as a lighting system, the edge light method (transparent material method), the direct lower part type (reflecting plate method), the source method of sheet-like light, etc. are learned (a liquid-crystal-display technique, p252-256, Sangyo Tosho Publishing Co., Ltd., date-of-issue November 8, 1996: a full color liquid crystal display technique, p201-202, Triceps, Inc., date-of-issue February 26, 1990). What is necessary is just to choose the optimal method as a lighting system 100 according to an application, the purpose, and a screen size from these method and other methods. Here, although the case where the thing of an edge light method is used as a lighting system 100 is explained, this invention is not limited to this.

[0079] The lighting system 100 has the transparent material 103 which consists of transparent acrylic resin which processed the dot printing 105 grade by white pigments at the rear face, the linear light source 101 which has been arranged to the end face of a transparent material 103 and which consists of a cold cathode tube, for example, the lamp cover 102, the reflective sheet 104 arranged at the rear face of a transparent material 103, the diffusion sheet 110,112 arranged in the front face of a transparent material 103, and the prism sheet 111.

[0080] In this configuration, after reflecting by direct or the lamp cover 102, incidence of the light which carried out outgoing radiation from the light source 101 is carried out to a transparent material 103. Although the light 1101 which carried out incidence to the transparent material 103 spreads the inside of a transparent material 103, carrying out total reflection, the light which resulted in the dot printing 105 by the white pigments given to the rear face of a transparent material 103 changes the travelling direction, and it carries out outgoing radiation from a transparent material 103 front-face side. The light which carried out outgoing radiation from the transparent material 103 is irradiated by the liquid crystal display panel 200 after outgoing radiation angular distribution and the luminance distribution in a field are equalized by the diffusion sheets 110 and 112 and prism sheet 111 grade.

[0081] Like drawing 8 , the liquid crystal display panel 200 is flat and transparent, and contains the 1st transparence substrate 201 and the 2nd transparence substrate 202 which consist of **** glass [ target / optical ] or plastics. The laminating of a color filter (un-illustrating), the transparent electrode 203 which consists of ITO (Indium Tin Oxide), and the orientation film 204 which consists of a polyimide system macromolecule is carried out to the transparence substrate 201. Switching elements (un-illustrating), such as the transparent electrode 205 which forms the 206 pixel orientation film and an electrode connected with this, and a thin film transistor, are formed in the 2nd transparence substrate 202. A fixed gap is prepared through the SU **-sir which does not illustrate the field in which the orientation film 204 and 206 is formed in two transparence substrates 201 and 202 between facing each other and two transparence substrates 201 and 202, a perimeter is further closed by the frame-like sealant 210, and space is formed in the interior. When a dielectric anisotropy encloses a forward nematic liquid crystal with this space, the liquid crystal layer 207 is formed.

[0082] The direction of orientation of the major axis of the liquid crystal molecule of the liquid crystal layer 207 is specified on two transparence substrates 201 and the orientation film 204 and 206 formed on 202 by performing orientation processing of rubbing etc. Here, 90 degrees is in the distorted condition continuously between the transparence substrates 201,202. In the tooth back of the transparence substrate 202, and the front face of the transparence substrate 201, the polarizing plate 209 and the absorption mold polarization selection member (polarizing plate) 208 are arranged, respectively so that the linearly polarized light the linearly polarized light and a polarization shaft cross at right angles mutually may be penetrated. the direction of orientation of the major axis of the liquid crystal molecule by the side of the transparence substrate 202 and the transparence substrate 201 -- a polarizing plate 209 and the transparency polarization shaft of the absorption mold polarization selection member (polarizing plate) 208 -- receiving -- both -- parallel -- or it constitutes so that it may both intersect perpendicularly.

[0083] What gave the protective layer of triacetyl cellulose can be used for both sides of the film which gave the polarization function by making the polyvinyl alcohol extended, for example absorb iodine as the absorption mold polarization selection member (polarizing plate) 208 and a polarizing plate 209. In addition, the absorption mold polarization selection member (polarizing plate) 208 and a polarizing plate 209 are pasted up on the transparence substrate 202 and the transparence substrate 201, respectively so that it may join together optically with acrylic adhesives.

[0084] By such configuration, the linearly polarized light which penetrated the polarizing plate 209 among the illumination light which carries out incidence from the tooth back (lighting-system 100 side) of the liquid crystal display panel 200 passes the liquid crystal layer 207, and it carries out incidence to the absorption mold polarization selection member (polarizing plate) 208. Under the present circumstances, the polarization condition of the light which penetrates the liquid crystal layer

207 can be changed with the electrical potential difference impressed to the liquid crystal layer 207. Therefore, the polarization condition of the light which passes the liquid crystal layer 207 can be changed, and the quantity of light which penetrates the absorption mold polarization selection member (polarizing plate) 208 can be controlled by impressing the electrical potential difference corresponding to the image information told from the image information generating section (un-illustrating) to transparent electrodes 203 and 205, and impressing electric field to the liquid crystal layer 207. Thereby, the image light of the request which consists of linearly polarized light light can be formed.

[0085] Below, the reflective mold polarization selection member 300 is explained.

[0086] The reflective mold polarization selection member 300 penetrates the 1st linearly polarized light component which carries out outgoing radiation from the image display section 1000, and the 2nd linearly polarized light component which has the polarization shaft which intersects perpendicularly with this uses what has the function which carries out specular reflection. What has arranged the quarter-wave length plate can be used for the birefringence reflective mold polarization film which carried out two or more layer laminating of the different form birefringence high polymer film currently indicated by international public presentation number:WO 95/No. 27919 of international application, for example by turns as such a member, or the table and flesh side of a cholesteric-liquid-crystal layer. In the case of a birefringence reflective mold polarization film, a predetermined linearly polarized light component is penetrated, the film which carries out specular reflection is marketed by the trade name of DBEF from 3M company (U.S.), and the linearly polarized light component a component and this and a polarization shaft cross at right angles can use this as a reflective mold polarization selection member 300. In addition, since the reflective mold polarization selection member 300 is an important member which functions as a mirror plane when changing this display into a mirror condition, that by which processing which obscures a reflected image like mat processing is not made is used for it.

[0087] On the other hand, when it is what has arranged the quarter-wave length plate and constitutes on the table and flesh side of a cholesteric-liquid-crystal layer as a reflective mold polarization selection member 300, the liquid crystal cell which stored low-molecular cholesteric liquid crystal between two transparence substrates by which orientation processing was carried out, and the thing in which the macromolecule cholesteric-liquid-crystal layer was formed on flat and substrates transparent in directions [ target / optical ], such as glass or transparence resin, can be used as a cholesteric-liquid-crystal layer. The unique optical property based on molecular arrangement with a helical cholesteric-liquid-crystal layer is shown, the light which carried out incidence in parallel with a helical shaft reflects the circular polarization of light of one hand of cut according to the hand of cut of a cholesteric spiral, and another side shows the selective reflection of penetrating. The wavelength region of selective reflection needs to carry out the laminating of two or more cholesteric-liquid-crystal layers from which a pitch differs, and to use them, in order to make it selective reflection happen throughout a visible wavelength region, since it is decided by the pitch of molecular arrangement. In this case, they are Asia Display95 Digest, p735, and The Institute of Television Engineers of Japan (ITE) &The Society for Information Display (SID) instead of piling up the two or more layers cholesteric-liquid-crystal layer from which a pitch differs, in order to acquire selective reflection throughout a visible wavelength region. The cholesteric-liquid-crystal layer to which a pitch which is indicated was changed continuously may be used.

[0088] When using for the table and flesh side of a cholesteric-liquid-crystal layer what has arranged the quarter-wave length plate as a reflective mold polarization selection member 300, the quarter-wave length plate arranged at a background [ of a cholesteric-liquid-crystal layer ] 1000, i.e., the image display section, side sets up the lagging axis in the following directions. That is, the lagging axis is arranged so that the 1st linearly polarized light which carries out outgoing radiation from the image display section 1000 and which carries out incidence to the reflective mold polarization selection member 300 may be changed into the circular polarization of light which penetrates a cholesteric-liquid-crystal layer. The quarter-wave length plate similarly arranged on the other hand at a side front [ of a cholesteric-liquid-crystal layer ] 400, i.e., transparency polarization shaft variant part, side arranges the lagging axis so that the circular polarization of light which penetrates a cholesteric-liquid-crystal layer may be changed into the 1st linearly polarized light.

[0089] Thus, when the 2nd linearly polarized light carries out incidence to the reflective mold polarization selection member of a configuration of having arranged the quarter-wave length plate on the table and flesh side of a cholesteric-liquid-crystal layer, the 2nd linearly polarized light is an operation of a quarter-wave length plate, and since the circular polarization of light which penetrates a cholesteric-liquid-crystal layer is changed into the circular polarization of light of the circumference of reverse, selective reflection of it is carried out in a cholesteric-liquid-crystal layer. In case the circular polarization of light reflected in the cholesteric-liquid-crystal layer penetrates a quarter-wave length plate again, it is changed into the 2nd linearly polarized light in the operation.
[0090] In addition, as for the quarter-wave length plate used for the reflective mold polarization selection member 300 of this configuration, it is desirable to use what functions as a quarter-wave length plate in the whole region of visible wavelength. The extended high polymer film which has high transmission in a visible wavelength region as a quarter-wave length plate, for example, polyvinyl alcohol, a polycarbonate, Pori Sall John, polystyrene, polyarylate, etc. can be used. In addition, the liquid crystal layer which arranged a mica, Xtal, or a molecule shaft with the one direction, and carried out orientation can be used.
[0091] Moreover, although it is difficult to constitute the phase contrast plate which functions as a quarter-wave length plate to the whole region of visible wavelength with one kind of phase contrast plate with the wavelength dependency (following, wavelength dispersion) of the refractive index of the quality of the material which generally constitutes a quarter-wave length plate What is necessary is just to use what was constituted so that it might function as a quarter-wave length plate in a large wavelength region by sticking at least two kinds of phase contrast plates with which wavelength dispersion differs so that the optical axis may be intersected perpendicularly.
[0092] In addition, as a reflective mold polarization selection member 300, like the laminating member of a birefringence reflective mold polarization film, or a film-like cholesteric-liquid-crystal layer and a quarter-wave length plate, when using a film-like member, it is cautious of the following points.
[0093] That is, only by having arranged in the front face of the image display section 1000, since surface smoothness is low if it remained as it is, a film-like reflective mold polarization selection member has much distortion, and is difficult to realize a practically satisfactory mirror. Then, when using a film-like member as a reflective mold polarization selection member 300, rigidity is high like a glass plate or a plastic sheet through a transparent binder, it is flat and transparent and it is desirable to carry out adhesion immobilization and to make it there be no distortion in a **** transparence [ target / optical ] base material.
[0094] Or since the reflective mold polarization selection member 300 is fixed in the flat condition, it can be made the configuration fixed to the liquid crystal display panel 200 or the transparence substrate of the below-mentioned transparency polarization shaft variant part 400 instead of carrying out adhesion immobilization at a new transparence base material. Anyway, when using a film-like member as a reflective mold polarization selection member 300, in order to realize a mirror without distortion, it is desirable to another flat member to carry out adhesion immobilization.
[0095] Below, the transparency polarization shaft variant part 400 is explained.
[0096] In case the linearly polarized light light which carried out incidence penetrates the transparency polarization shaft variant part 400, it can change the polarization condition and, as for the linearly polarized light which carried out incidence, a liquid crystal device which is a selectable configuration, for example, illustrates the condition of making it changing to the linearly polarized light light light and a polarization shaft cross at right angles, or the condition of not changing a polarization condition, to drawing 8 can be used for it.
[0097] This transparency polarization shaft variant part 400 contains the 2nd transparence substrate 402 with which laminating formation of a transparent electrode 406 and the orientation film 405 was carried out extensively, and the liquid crystal layer 407 as well as the 1st transparence substrate 401 with which laminating formation of the transparent electrode 403 which consists of ITO, and the orientation film 404 which consists of a polyimide system macromolecule was carried out extensively. In addition, the transparent electrodes 403 and 406 formed in two transparence substrates 401,402, respectively are connected to the power source through wiring which is not illustrated and a changeover switch 813 ( drawing 8 un-illustrating [ referring to drawing 1 ]).

Therefore, either condition of the condition of not impressing an electrical potential difference to transparent electrodes 403 and 406, and the condition of impressing an electrical potential difference is constituted selectable. That is, there is no potential difference in a transparent electrode 403,406, and the condition that electric field are not impressed to the liquid crystal layer 407, and one condition of the conditions that impress an electrical potential difference to a transparent electrode 403,406, and electric field are impressed to the liquid crystal layer 407 are constituted selectable.
[0098] The liquid crystal layer 407 of the transparency polarization shaft variant part 400 arranges two transparence substrates 401,402 so that the forming face of the orientation film may face each other, prepares a fixed gap between two transparence substrates 401 and 402 by inserting the spacer which is not illustrated, carries out the seal of the perimeter of this gap to the shape of a frame by the sealant 410, forms space, and constitutes it from a dielectric anisotropy enclosing a forward nematic liquid crystal with this space.
[0099] In addition, as a transparency polarization shaft variant part 400, orientation processing of rubbing processing etc. is performed on the orientation film 404,405 formed in two transparence substrates 401,402, respectively, and the case of the so-called TN liquid crystal device which constituted the liquid crystal molecule major axis of the liquid crystal layer 407 so that 90 degrees might be continuously twisted between two transparence substrates 401,402 is explained here.
[0100] In this case, the direction of orientation of the liquid crystal molecule major axis by the side of the transparence substrate 402 is constituted so that it is parallel or may intersect perpendicularly with the linearly polarized light transparency polarization shaft of the absorption mold polarization selection member (polarizing plate) 208 of the liquid crystal display panel 200, and the liquid crystal layer 407 is constituted so that the conditions of a wave guide may be fulfilled in a visible wavelength region. The conditions of a wave guide are for example, J.Phys.D. : It is indicated by the paper by page [ 1575-1584th ] C.H.Gooch of Appl.Phys.Vol.8 (1975), and H.A.Tarry.
[0101] Here, the birefringence of liquid crystal was made into d-delta n= 0.4452 (wavelength of 633nm) when thickness of deltan and a liquid crystal layer was set to d.
[0102] By the above-mentioned configuration, the transparency polarization shaft variant part 400 of this example does not have the potential difference in the transparent electrode 403,406 formed in two transparence substrates 401,402, respectively, and carries out outgoing radiation from the image display section 1000 by the OFF state by which electric field are not impressed to the liquid crystal layer 407, and the 1st linearly polarized light which penetrated the reflective mold polarization selection member 300 changes to the 2nd linearly polarized light light the 2nd and this and a polarization shaft cross at right angles. In the ON state which impresses an electrical potential difference to the transparent electrode 403,406 formed in two transparence substrates 401,402, respectively on the other hand and by which electric field are impressed to the liquid crystal layer 407, outgoing radiation is carried out from the image display section 1000, and the 1st linearly polarized light light which penetrated the reflective mold polarization selection member 300 is penetrated, without the polarization shaft changing. Under the present circumstances, when the electrical potential differences impressed to a transparent electrode 403,406 were **5V and 60Hz, they fully functioned.
[0103] In addition, in the example 1, although the case of TN liquid crystal device was shown as a transparency polarization shaft variant part 400, this invention is not limited to this. That is, in case the linearly polarized light light which carried out incidence penetrates the transparency polarization shaft variant part 400, it can use an ECB (Electrically Controlled Birefringence) liquid crystal device, a strong dielectric liquid crystal device, an antiferroelectric liquid crystal device, etc. other than the above-mentioned TN liquid crystal device that the linearly polarized light light which the polarization shaft was changed and carried out incidence should just be the section selectable in either condition of the condition of making it changing to the linearly polarized light light light and a polarization shaft cross at right angles, and the condition of not changing a polarization shaft.
[0104] Below, the absorption mold polarization selection member 500 is explained.
[0105] Or the absorption mold polarization selection member 500 absorbs the linearly polarized light component of [ 1st ] the light which carried out incidence and it penetrates the 2nd linearly polarized light component the 2nd and this and a polarization shaft cross at right angles, the 1st linearly polarized light component is penetrated, and the 2nd linearly polarized light component has the

function to absorb, and can use the so-called polarizing plate. That is, the polarizing plate which gave the protective layer of triacetyl cellulose can be used for both sides of the film which the polyvinyl alcohol made to extend for example was made to absorb iodine as an absorption mold polarization selection member 500, and gave the polarization function.

[0106] In addition, in order to suppress degradation of the image quality by reflected, as for the absorption mold polarization selection member 500, it is desirable to perform processing which suppresses specular reflection on the front face. However, the method of important one forming detailed irregularity in a front face as processing of specular reflection prevention of the absorption mold polarization selection member 500, since the display of this invention functions also as a mirror, or forming the transparence resin layer containing a transparence particle in a front face here, and reducing a specular reflection component is not desirable. Although the image display engine performance improves by reflected reduction when such processing is carried out, it is because the problem that the image reflected in a mirror fades and the engine performance of a mirror deteriorates arises.

[0107] Therefore, it is desirable to form an antireflection film in the front face as processing of specular reflection prevention of the absorption mold polarization selection member 500. A technique well-known as an antireflection film can be used. Namely, what is necessary is just to use the approach of applying low refractive-index ingredients, such as the approach of carrying out the multilayer coat of several sorts of metallic oxides with which the refractive indexes by which the optical design was carried out differ by vacuum evaporationo, or a fluorine compound.

[0108] Below, drawing 9 is used and explained about the shaft orientation of each part material of the display of this example.

[0109] Here, the absorption mold polarization selection member 500 absorbs the linearly polarized light component of [ 1st ] the light which carried out incidence, and the 2nd linearly polarized light component the 2nd and this and a polarization shaft cross at right angles shows the case where it penetrates. In addition, the include angle of each shaft is shown at an angle of the circumference of a reverse clock from here on the basis of the location at horizontal direction 3:00 of an image display side. Since when TN liquid crystal display panel is used as a liquid crystal display panel 200 which constitutes the image display section 1000 acquires the horizontal symmetric property of a viewing-angle property as shown in drawing 9 , the transparency polarization shaft of the linearly polarized light of a polarizing plate usually makes it into 135 degrees (or 45 degrees and this example 135 degrees). Therefore, the transparency polarization shaft of the linearly polarized light of the reflective mold polarization selection member 300 is also the same, and the direction of orientation of the liquid crystal molecule major axis by the side of the transparence substrate 402 of 135 degrees and the transparency polarization shaft variant part 400 and the transparence substrate 401 makes 45 degrees the transparency polarization shaft of the linearly polarized light of 135 degrees, 45 degrees, and the absorption mold polarization selection member 500, respectively.

[0110] Next, actuation of the display of this example 1 is explained using drawing 10 and drawing 11 .

[0111] The case where the display of an example 1 is in an image display condition is explained using drawing 10 . When a display is in an image display condition, the transparency polarization shaft variant part 400 sets a changeover switch 813 to OFF so that it may be in the condition, i.e., an OFF state, of not impressing an electrical potential difference to the liquid crystal layer 407 which constitutes this. Outgoing radiation of the linearly polarized light which carried out outgoing radiation from the lighting system 100 of the image display section 1000, and penetrated the absorption mold polarization selection member (polarizing plate) 208 of the liquid crystal display panel 200 is carried out from the image display section 1000 as an image light 3001. The image light 3001 which consists of this 1st linearly polarized light penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400. The image light 3001 which passes the transparency polarization shaft variant part 400 changes from the 1st linearly polarized light to the 2nd linearly polarized light. Incidence of the image light 3001 of the 2nd linearly polarized light which penetrated the transparency polarization shaft variant part 400 is carried out to the absorption mold polarization selection member 500. Since the absorption mold polarization selection member 500 absorbs the 1st linearly polarized light component and the 2nd linearly polarized light component penetrates, the image light 3001 of the 2nd linearly polarized light penetrates the absorption mold polarization selection member 500, and is observed by the observer.

[0112] On the other hand, although the outdoor daylight 3002 which carries out incidence from an observer side (left-hand side in drawing) to a display is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed and only the 2nd linearly polarized light component penetrates it. In case the outdoor daylight 3002 which penetrated the absorption mold polarization selection member 500 penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light to the 1st linearly polarized light, penetrates the reflective mold polarization selection member 300, and goes to the image display section 1000. This light hardly returns to an observer side as the gestalt of the 1st operation explained it.

[0113] Therefore, in the state of image display, since the image light 3001 which carried out outgoing radiation from the image display section 1000 turns on an observer, without losing almost, it can obtain a bright image. Furthermore, since outdoor daylight 3002 is not reflected by the reflective mold polarization selection member 300 which functions as a mirror in the case of a mirror condition, degradation of the image quality resulting from outdoor daylight, such as reflected and a fall of a contrast ratio, hardly takes place.

[0114] Drawing 11 shows the case where this display is in a mirror condition. When this display is in a mirror condition, as the transparency polarization shaft variant part 400 considers as the ON state which impresses electric field to the liquid crystal layer 407 which constitutes this, it turns ON a changeover switch 813. In this case, although the outdoor daylight 3002 which faces to this display from an observer side is unpolarized light, in case it penetrates the absorption mold polarization selection member 500, the 1st linearly polarized light component is absorbed, only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. The outdoor daylight 3002 which carried out incidence to the transparency polarization shaft variant part 400 at this time penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light light, without a polarization shaft changing, and results in the reflective mold polarization selection member 300. In order that the reflective mold polarization selection member 300 may penetrate the 1st linearly polarized light component and may carry out specular reflection of the 2nd linearly polarized light component, outdoor daylight 3002 reflects it by the reflective mold polarization selection member 300. Since the outdoor daylight 3002 reflected by the reflective mold polarization selection member 300 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, also penetrates the polarization selection member 500 further and turns on an observer, a mirror condition realizes it.

[0115] Under the present circumstances, in the image display section 1000 of this example, since it has the absorption mold polarization selection member (polarizing plate) 208, the image light of a dark viewing area is absorbed by the absorption mold polarization selection member (polarizing plate) 208, and does not result in the reflective mold polarization selection member 300. Therefore, the leakage of light can be sharply reduced from a dark display field regardless of the reflective engine performance of the reflective mold polarization selection member 300.

[0116] Moreover, the image light 3001 by which outgoing radiation is carried out from a clear display field among the image light which carries out outgoing radiation from the image display section 1000 penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400. When this display is in a mirror condition, the transparency polarization shaft variant part 400 is an ON state, and in order to penetrate with the 1st linearly polarized light light, without a polarization shaft changing, the image light 3001 which penetrates the transparency polarization shaft variant part 400 at this time is absorbed by the absorption mold polarization selection member 500, and is hardly observed by the observer.

[0117] That is, ideally, since the light of the one half of unpolarized light reflects by the reflective mold polarization selection member 300 and goes to an observer side, the outdoor daylight 3002 which the light from an image display member does not result at an observer in the case of a mirror

condition, and carries out incidence to a display from a perimeter on the other hand functions as a bright mirror.
[0118] Moreover, the display of this example is a configuration which turns ON the transparency polarization shaft variant part 400, and makes liquid crystal molecule 407a stand in a mirror condition. Generally the gap of the polarization shaft of light made to carry out outgoing radiation in the direction of slant is smaller than the time of being in the condition in which the liquid crystal molecule of electrical-potential-difference OFF of the direction of the condition that pneumatic mold liquid crystal made the liquid crystal molecule of electrical-potential-difference ON stand was twisted. For this reason, as compared with the thing of a configuration of making the display of the gestalt of this operation electrical-potential-difference OFF in the state of the mirror stated by the Prior art, the effectiveness that there is little optical leakage by the direction of slant of the image light (clear display light) 3001 is also acquired in a mirror condition.
[0119] In addition, the property of the polarizing plate which functions as the absorption mold polarization selection member 208 or an absorption mold polarization selection member 500 is directly related to the ease of being visible of the image quality of an image display condition, or the mirror of a mirror condition. Specifically, the high thing of the permeability of a polarizing plate is desirable in order to contribute to the brightness of the image in an image display condition, and the brightness of the reflected image in a mirror condition. Moreover, the degree of polarization of a polarizing plate is directly related to the contrast ratio in an image display condition, and the amount of unnecessary reflection of outdoor daylight. Since the contrast ratio of image display becomes high and unnecessary reflection of outdoor daylight becomes small so that the degree of polarization of a polarizing plate is high, the high thing of the degree of polarization of a polarizing plate is desirable. Since the mirror condition which the leakage of the light from an image display member becomes small, and the contrast ratio of a reflected image improves, and is easier to be in sight is realized so that degree of polarization is high also in a mirror condition, the more high thing of the degree of polarization of a polarizing plate is desirable.
[0120] therefore, the polarizing plate used as the absorption mold polarization selection member 208 or an absorption mold polarization selection member 500 -- high permeability -- in addition -- and it is desirable to use the polarizing plate of high degree of polarization. However, generally between the permeability of a polarizing plate, and degree of polarization, the relation of a trade-off which is illustrated to drawing 12 exists (a Japanese east technical report, Vol38, No.1, May2000, pp 11-14). Drawing 12 is a graph which shows the general relation of the permeability and degree of polarization of an iodine system polarizing plate, an axis of abscissa shows the permeability of a polarizing plate, and an axis of ordinate shows degree of polarization. For this reason, selection of the property of the polarizing plate used as the absorption mold polarization selection member 208 and an absorption mold polarization selection member 500 becomes very important for the image quality of an image display condition, and coexistence of the mirror engine performance in a mirror condition.
[0121] Drawing 3 and drawing 4 are graphs which show the leakage of the light from the image display section 1000 in a mirror condition. Drawing 3 expresses the size of the leakage of the light of a dark display by the clear display section and drawing 4 with a brightness value. It is data in the conditions to which these graphs carry out clear display of brightness value 450 cd/m2 when an indicating equipment is in an image display condition, and an axis of abscissa shows the location on an indicating-equipment display, and an axis of ordinate shows the brightness value in the direction of a transverse plane. Moreover, the type of the polarizing plate which A type polarizing plate in drawing, B type polarizing plate, and C type polarizing plate used as an absorption mold polarization selection member 208 is shown, the absorption mold polarization selection member 208 is lost for a comparison, and other configurations are also writing together the optical leakage at the time of making it the same as the display of this example 1. Drawing 3 and A type polarizing plate of drawing 4 are [ 43.6% of permeability, 99.5% of degree of polarization, and C type polarizing plate of 41.5% of permeability, 99.97% of degree of polarization, and B type polarizing plate ] 45.4% of permeability, and 96.60% of degree of polarization. In addition, A type polarizing plate is used for the data of drawing 3 and drawing 4 as an absorption mold polarization selection member 500.
[0122] It turns out that implementation can do the mirror in which the leakage of light is decreasing

remarkably and projects the high reflected image of a contrast ratio as compared with the case where there is no absorption mold polarization selection member 208, by having had the absorption mold polarization selection member 208 even if it was which polarizing plate A type, B type, and C type as shown in drawing 3 and drawing 4 . Especially, when degree of polarization is 99.5% or more of A type and B type polarizing plate, it turns out that implementation can do the high-definition mirror condition that the leakage of the light in a dark display decreases remarkably, and projects a reflected image with a higher contrast ratio as shown in drawing 4 .

[0123] Therefore, as for the degree of polarization of the polarizing plate used as an absorption mold polarization selection member 208, it is desirable that it is at least 96.60% or more, and in order to realize a more nearly high-definition mirror condition, it is more desirable [ degree of polarization ] for degree of polarization to be 99.5% or more.

[0124] On the other hand, drawing 13 is a graph which shows the relation between the degree of polarization of the polarizing plate used as an absorption mold polarization selection member 500, and the reflection factor of the mirror in a mirror condition and the reflection factor (unnecessary reflection factor) of the outdoor daylight in an image display condition. The degree of polarization of the polarizing plate which an axis of abscissa uses as an absorption mold polarization selection member 500, and an axis of ordinate show a reflection factor. the degree of polarization of the polarizing plate used as an absorption mold polarization selection member 500 as drawing 13 -- 99.97 to 96.60% -- lowering -- more -- high -- by considering as a permeability thing, the reflection factor in a mirror condition improves about 10%, and a brighter mirror can be realized. Under the present circumstances, the increment in the unnecessary reflection factor in an image display condition was small.

[0125] Drawing 14 is a graph which shows an example of the relation of the brightness value of the clear display in the degree of polarization and image display condition of the polarizing plate used as an absorption mold polarization selection member 208, an axis of abscissa shows the degree of polarization of a polarizing plate, and an axis of ordinate shows relative luminance. In addition, the data of drawing 14 are data in the case of using A type polarizing plate as an absorption mold polarization selection member 500. As drawing 14, the brightness value rose about 9.5% by reducing the degree of polarization of the polarizing plate used as an absorption mold polarization selection member 208 with 99.97 to 96.60%, and making it into the thing of high permeability, and the brighter image was obtained. This relation was also the same as when the property of the polarizing plate of the absorption mold polarization selection member 208 is fixed and the degree of polarization of the polarizing plate of the absorption mold polarization selection member 500 is changed.

[0126] Moreover, when degree of polarization used 99.5% or more of polarizing plate for either the absorption mold polarization selection member 208 or the absorption mold polarization selection members 500, even if the degree of polarization of the polarizing plate of another side was 96.6% or less, sufficient contrast ratio was obtained. Therefore, it is effective to use a polarizing plate with high degree of polarization for one of the polarizing plates of the absorption mold polarization selection member 208 and the absorption mold polarization selection members 500, in order to improve brightness, and to use a polarizing plate with low degree of polarization for another side, maintaining sufficient contrast ratio in an image display condition.

[0127] As mentioned above, when the degree of polarization of the polarizing plate of the absorption mold polarization selection member 208 is set to P1 and the degree of polarization of the polarizing plate of the absorption mold polarization selection member 500 is set to P2, since it is compatible on high level in the brightness of the display image in an image display condition, a contrast ratio and the contrast ratio of the reflected image in a mirror condition, and brightness, it is desirable to satisfy the following conditions.

Conditions 1 $0.966 <= P1 <= 0.995 <= P2$.

Conditions 2 $0.966 <= P2 <= 0.995 <= P1$ is satisfied and an image display member is surely considered as a dark display in the state of a mirror.

[0128] In addition, the reason to which it was presupposed that an image display member is surely considered as a dark display in the state of a mirror on conditions 2 is that the leakage of the light from a clear display field becomes large, and the contrast ratio of a reflected image falls remarkably when the degree of polarization of the polarizing plate of the absorption mold polarization selection member 500 is low. Then, by considering as a dark display, the leakage of light is prevented and the fall of a contrast ratio is prevented.

[0129] In addition, the change section which interlocks lighting of a lighting system 100 and putting out lights with the change of the changeover switch 813 of the transparency polarization shaft variant part 400 is prepared, and you may make it switch off a lighting system in the display of this example 1 in the case of a whole surface mirror condition. In this case, since light is not outputted from the image display section 1000, while the legible mirror in which there is no leakage of light and a reflected image with a high contrast ratio is acquired is realizable, only the part which put out the light is effective in the ability to reduce the power consumption of a display.

[0130] moreover, the thing for which it considers the field of the image display section 1000 which does not switch off a lighting system but corresponds to the field of a mirror condition as a dark display in making some screens into a mirror condition and displaying an image on the remaining part -- high -- implementation of the mirror which realizes a contrast ratio reflected image, and a bright image display field are realizable on the same screen.

[0131] According to the display of this invention the above-mentioned passage, the reflective mold polarization selection member 300 is effectually switched to a transparent condition and the condition of functioning as a mirror by control of the polarization condition by the transparency polarization shaft variant part 400. Therefore, a bright image is obtained by making the reflective mold polarization selection member 300 into a transparent condition effectually in the state of image display. Moreover, since outdoor daylight is hardly reflected with a display even if a perimeter is a bright environment, degradation of the image quality of the fall of reflected [ like / in the case of using a half mirror ] and the contrast ratio accompanying it does not arise. That is, a switch of an image display condition and a mirror condition can be realized, without deteriorating the mutual engine performance.

[0132] Moreover, in the image display section 1000 of this example, since it has the absorption mold polarization selection member (polarizing plate) 208, the image light of a dark viewing area is absorbed by the absorption mold polarization selection member (polarizing plate) 208, and does not result in the reflective mold polarization selection member 300. Therefore, the leakage of light can be sharply reduced from the dark display field in a mirror condition regardless of the reflective engine performance of the reflective mold polarization selection member 300.

[0133] In addition, although the above-mentioned example showed the case where the 1st linearly polarized light component penetrate the 2nd linearly polarized light component as an absorption mold polarization selection member 500, and the 1st and this and a polarization shaft cross at right angles was absorbed, the 1st linearly polarized light component is penetrated as an absorption mold polarization selection member 500, and you may make it the 2nd linearly polarized light component use what is absorbed. In this case, it will be in a mirror condition in the condition, i.e., an OFF state, that the transparency polarization shaft variant part 400 does not impress an electrical potential difference to the liquid crystal layer 407, and will be made to be in an image display condition in the condition, i.e., an ON state, that the transparency polarization shaft variant part 400 impresses an electrical potential difference to the liquid crystal layer 407. That is, when the power of the whole display is off, it can consider as a mirror condition. When adopting this display as a hand-held PC and a device which is called a cellular phone and which wants to make power consumption small as it can do, since it can realize a mirror function in the condition that there is no power consumption, this becomes very advantageous.

[0134] In addition, in the display of this example 1, since reflection of the light in the interface of a configuration member is reduced, it is also possible to make each part material the configuration optically combined with the transparent binder with which the refractive index was doubled.

[0135] (Example 2) The display with a change function to the mirror condition of the example 2 of this invention is explained using drawing 15 and drawing 16 . The basic configuration of the display of this example 2 is the same as that of the display shown in drawing 1 of the gestalt of the 2nd operation, and drawing 2 . That is, the display of this example 2 transposes the absorption mold polarization selection member 500 of the display explained in the example 1 to the combination of the reflective mold polarization selection member 301 and the adjustable polarization selection member 600. Therefore, the same sign is attached to the same part as an example 1, and detailed explanation of the part is omitted.

[0136] The reflective mold polarization selection member 301 which replaces with the absorption mold polarization selection member 500 of the display of an example 1, reflects the 1st linearly polarized light component, and penetrates the 2nd linearly polarized light component as the configuration of this display was shown in drawing 15 and drawing 16 , Absorbing the linearly polarized light component of [ 1st ] the light which carried out incidence, the 2nd linearly polarized light component arranges the selectable adjustable polarization selection member 600 sequentially from the transparency polarization shaft variant part 400 side in either condition of the condition of penetrating, and the condition of penetrating all polarization components.

[0137] In addition, an observer will observe this display from the adjustable polarization selection member 600 side (left-hand side in drawing).

[0138] what consists of a liquid crystal display panel 200 which displays an image, and a lighting system 100 arranged at the tooth back has been used by adjusting the amount of transmitted lights of light as the image display section 1000.

[0139] In this example 2, below, with reference to drawing 16 , although the case where TN liquid crystal display panel is used as an edge light method and a display panel 200 as a lighting system 100 is explained, this invention is not limited to this like (an example 1).

[0140] The reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 penetrate a predetermined linearly polarized light component, and carry out specular reflection of the linearly polarized light component which has the polarization shaft which intersects perpendicularly with this. The member which carried out the laminating of the quarter-wave length plate to the birefringence reflective mold polarization film stated in (the example 1) as such a member or a cholesteric-liquid-crystal layer and its table, and a flesh side can be used.

[0141] In addition, it is made to be the following when using the member of the shape of a film of the laminating member of a refraction reflective mold polarization film, or a film-like cholesteric-liquid-crystal layer and a quarter-wave length plate as the reflective mold polarization selection member 300 and a reflective mold polarization selection member 301. namely, -- if a film-like reflective mold polarization selection member remains as it is -- since surface smoothness is low -- a transparent binder -- minding -- the rigidity of a glass plate or a plastic sheet -- high -- flat -- in addition -- and -- transparent -- optical -- etc. -- it is desirable to carry out adhesion immobilization and to make it there be no distortion in a **** transparence base material. It may be made to carry out adhesion immobilization of the film-like reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 at substrates of other adjoining members, such as a transparence substrate of the liquid crystal display panel 200, etc.

[0142] In case the linearly polarized light light which carried out incidence penetrates, the linearly polarized light light which the polarization shaft was changed and carried out incidence is the section selectable in either condition of the condition of making it changing to the linearly polarized light light light and a polarization shaft cross at right angles, and the condition of not changing a polarization shaft, and the liquid crystal device explained in (the example 1) can be used for the transparency polarization shaft variant part 400.

[0143] In this example, the transparency polarization shaft variant part 400 is arranged between the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301. The reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 are members which function as a reflector, when this display is made into a mirror condition. For this reason, since parallax will arise in the image reflected, respectively by the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 if spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 becomes large, as for both spacing, it is desirable to make it as small as possible. That is, as for the thickness of the transparency polarization shaft variant part 400 arranged between the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301, it is desirable to make it as thin as possible.

[0144] The display of this example 2 makes it the main applications for people to copy and observe their face in the state of a mirror. The average of an adult man's total face height is 234.6mm (human-engineering criteria numeric-value formula handbook; in 1992). Since it is Gihodo Shuppan, the vertical distance from an eye to the edge of a face is assumed to be 117.3mm of the one half. If this display of a mirror condition and distance of an eye are set to 300mm and it takes into consideration that it is "the definition of the resolution of average eyesight 1.0 is a minimum of 1 minute at a viewing angle" (the definition of eyesight; 1909 international ophthalmology meeting) further In order not to give parallax, as for spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301, it is desirable to be referred to as 0.11mm or less from geometric calculation.

[0145] That is, parallax will be produced in the image reflected when the glass substrate with a thickness of 0.7mm generally used for the liquid crystal device now was adopted as the transparence substrates 401 and 402 of the transparency polarization shaft variant part 400 and this display was in a mirror condition. Therefore, in order to realize the mirror which does not have parallax practically, it is desirable to use a transparence substrate 0.05mm or less as transparence substrates 401 and 402. Glass or a high polymer film can be used as such transparence substrates 401 and 402. Especially as a high polymer film, triacetyl cellulose, the polycarbonate which is not extended [ which formed membranes by the casting method (the solution casting method) ] can be used as a thing without optical anisotropy.

[0146] Or the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 are arranged to the liquid crystal layer 407 side rather than the transparence substrates 401 and 402, and since spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 will become thickness extent of a liquid crystal layer if it constitutes so that the liquid crystal layer 407 may be pinched, a mirror condition without parallax is realizable.

[0147] In addition, since some parallax is permitted depending on an application, this invention does not except the case where spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 is not the above-mentioned value.

[0148] On the other hand, the 2nd linearly polarized light component the adjustable polarization selection member 600 absorbs the linearly polarized light component of [ 1st ] the light which carried out incidence, and the 2nd and this and a polarization shaft cross at right angles is a selectable member about either condition of the condition of penetrating, and the condition that all polarization components penetrate. As such the section, the liquid crystal device of a guest host mold can be used. Here, the adjustable polarization selection member 600 using a guest host mold liquid crystal device is explained with reference to drawing 17 and 18.

[0149] The adjustable polarization selection member 600 using a guest host mold liquid crystal device contains the 1st transparence substrate 601 with which laminating formation of the orientation film 604 which consists of the transparent electrode 603 and polyimide system macromolecule which consist of ITO was carried out extensively, the 2nd transparence substrate 602 with which laminating formation of a transparent electrode 606 and the orientation film 605 was carried out extensively, and the liquid crystal layer 607 of the guest host mold inserted into these.

[0150] In addition, it connects with the power source through wiring and changeover switch 600a, and the transparent electrodes 603 and 606 formed in two transparence substrates 601,602, respectively can choose either condition of the condition of not impressing an electrical potential difference to transparent electrodes 603 and 606, and the condition of impressing an electrical potential difference. That is, there is no potential difference in a transparent electrode 603,606, and the condition that electric field are not impressed to the liquid crystal layer 607, and one condition of the conditions that impress an electrical potential difference to a transparent electrode 603,606, and electric field are impressed to the liquid crystal layer 407 are constituted selectable.

[0151] The liquid crystal layer 607 arranges two transparence substrates 601,602 so that an orientation film forming face may face each other, it sandwiches the spacer which is not illustrated further, prepares a fixed gap between two transparence substrates 601 and 602, carries out the seal of the perimeter of this gap to the shape of a frame by the sealant 610, forms space, and constitutes it from enclosing the liquid crystal of a guest host mold with this space.

[0152] Here, actuation of the adjustable polarization selection member 600 is explained with reference to drawing 17 and drawing 18 . drawing 17 and drawing 18 show an example of the adjustable polarization selection member 600 -- it is an outline sectional view a part. The liquid crystal layer 607 of a guest host mold adds dichroic coloring matter 6071 as a guest to a nematic liquid crystal 6072. the orientation film 604 and 605 with which, as for the direction of orientation of a liquid crystal molecule major axis, the dielectric anisotropy performed rubbing processing using forward liquid crystal as a nematic liquid crystal in this example -- substrates 601 and 602 -- receiving -- an abbreviation horizontal -- it is -- in addition -- and it carries out to two transparence substrates 601 and the orientation which does not have a twist among 602, i.e., homogeneous orientation. A pre tilt from which the direction of orientation of two transparence substrates [ 601 or about 602 ] becomes parallel mutually at this time is attached. As for the include angle of a pre tilt, it was desirable to attach 2 degrees or more so that a reverse tilt may not happen, and about 4-degree pre tilt was attached here.

[0153] Here, dichroic coloring matter 6071 is having cylindrical structure, and there is a property which carries out orientation in the direction parallel to a liquid crystal molecule. For this reason, if the orientation of a liquid crystal molecule is horizontally changed perpendicularly to a substrate, for example, dichroic coloring matter will also be taught by this and orientation will change perpendicularly horizontally. Here, thickness of the liquid crystal layer 607 was set to 5 micrometers using the guest host liquid crystal ingredient LA 121/4 (trade name) by Mitsubishi Kasei Corp. as a liquid crystal layer 607.

[0154] Drawing 17 does not have the potential difference among the transparent electrodes 603 and 606 formed in two transparence substrates 601 and 602, respectively, and the condition, i.e., changeover switch 600a, that electric field are not impressed to the liquid crystal layer 607 shows an OFF state. in this case, the nematic liquid crystal 6072 of the liquid crystal layer 607 -- an initial orientation condition, i.e., a substrate, -- abbreviation -- a horizontal (longitudinal direction of the space in drawing) -- it is homogeneous orientation, and orientation also of the dichroic coloring matter 6071 is learned and carried out to this. dichroic coloring matter 6071 -- a molecule shaft -- abbreviation -- it has an parallel absorption polarization shaft, and a polarization component parallel to a molecule shaft is absorbed strongly, and the polarization component which intersects perpendicularly with this has the property in which it hardly absorbs. For this reason, in case the incident light 5000 with various plane of polarization which carries out incidence from a perpendicular direction mostly to a transparence substrate side passes the liquid crystal layer 607, the linearly polarized light component Lp which has the oscillating direction of an electric vector parallel to the molecule shaft of dichroic coloring matter 6071 is absorbed, and it penetrates the linearly polarized light component Ls which intersects perpendicularly with this.

[0155] The condition which drawing 18 impressed the electrical potential difference to the transparent electrodes 603 and 606 formed in two transparence substrates 601 and 602, respectively, and impressed electric field to the liquid crystal layer 607, i.e., changeover switch 600a, shows an ON state. In this case, the direction of orientation of the molecule major axis of a nematic liquid crystal 6072 changes perpendicularly horizontally to two transparence substrates 601 and 602, and the direction of orientation of dichroic coloring matter 6071 also changes perpendicularly in connection with this. For this reason, the incident light 5000 with various plane of polarization which carries out incidence from a perpendicular direction mostly to a transparence substrate side is penetrated, without absorbing almost all the polarization component. Under the present circumstances, in this example, the electrical potential difference impressed to the transparent electrodes 603 and 606 of the transparence substrates 601 and 602 was set to **30V and 60Hz.

[0156] Therefore, if the direction of orientation of a liquid crystal molecule is made in agreement with the polarization shaft of the 1st linearly polarized light, the 2nd linearly polarized light component absorb the linearly polarized light component of [ 1st ] the light which carried out incidence, and the 2nd and this and a polarization shaft cross at right angles can realize a selectable adjustable polarization selection member for either condition of the condition of penetrating, and the condition that all polarization components penetrate.

[0157] In addition, to the adjustable polarization selection member 600, in order to suppress degradation of the image quality by reflected [ outdoor daylight ], it is desirable to perform processing which suppresses specular reflection on the front face. However, the method of important one forming detailed irregularity in a front face as processing of specular reflection prevention of the adjustable polarization selection member 600, since the display of this invention functions also as a mirror, or forming the transparence resin layer containing a transparence particle in a front face here, and reducing a specular reflection component is not desirable. Although the image display engine performance improves by reflected reduction when such processing is carried out, it is because the problem that the image reflected in a mirror fades and the engine performance of a mirror deteriorates arises. Therefore, it is desirable to form an antireflection film in the front face as processing of specular reflection prevention of the adjustable polarization selection member 600. A technique well-known as an antireflection film can be used. That is, the approach of applying low refractive-index ingredients, such as the approach of carrying out the multilayer coat of several sorts of metallic oxides with which the refractive indexes by which the optical design was carried out differ by vacuum evaporationo, or a fluorine compound, can be used.

[0158] Drawing 19 is the explanatory view of the shaft orientation of each part material of this example. In addition, the display of the include angle of each shaft is shown at an angle of the circumference of a reverse clock from here on the basis of the location at 3:00 of an image display side horizontal direction. The transparency polarization shaft of the linearly polarized light of the absorption mold polarization selection member (polarizing plate) 208 of TN liquid crystal display panel 200 which constitutes the image display section 1000 is made into 135 degrees as shown in drawing 19 . Therefore, the transparency polarization shaft of the linearly polarized light of the reflective mold polarization selection member 300 is also the same, and, as for the direction of orientation of the liquid-crystal molecule major axis by the side of the transparence substrate 402 of 135 degrees and the transparency polarization shaft variant part 400, and the transparence substrate 401, the transparency polarization shaft of the linearly polarized light of 135 degrees, 45 degrees, and the reflective mold polarization selection member 301 makes 135 degrees both the directions of orientation of the liquid-crystal molecule major axis by the side of the transparence substrate 602 of 45 degrees and the adjustable polarization selection member 600 and the transparence substrate 601, respectively.

[0159] Next, actuation of the display of an example 2 is explained with reference to a drawing. Drawing 20 and drawing 21 are the outline block diagrams for explaining the basic configuration and actuation of this display.

[0160] This example describes the case where the adjustable polarization selection member 600 absorbs the 1st linearly polarized light component (the space vertical direction in drawing) by the OFF state, penetrates the 2nd linearly polarized light component (space perpendicular direction in drawing) the 2nd and this and a polarization shaft cross at right angles, and penetrates all polarization components by the ON state.

[0161] Moreover, as a transparency polarization shaft variant part 400, in case the linearly polarized light light which carried out incidence penetrates, it is made to change to the linearly polarized light light and a polarization shaft cross at right angles, and the case where a polarization shaft is not changed is described as the linearly polarized light light which the polarization shaft was changed and carried out incidence by the ON state at an OFF state.

[0162] Drawing 20 shows the case of an image display condition. When this display is in an image display condition, the transparency polarization shaft variant part 400 carries out to the condition, i.e., an OFF state, of not impressing an electrical potential difference to the liquid crystal layer 407 which constitutes this. Moreover, also let the adjustable polarization selection member 600 be an OFF state.

[0163] The image display section 1000 consists of lighting systems 100 arranged at the tooth back with the liquid crystal display panel 200, and carries out outgoing radiation from a lighting system 100, and the 1st linearly polarized light which penetrated the absorption mold polarization selection member (polarizing plate) 208 of the liquid crystal display panel 200 carries out outgoing radiation from the image display section 1000 as an image light 3001 as already stated. The image light 3001 which consists of the 1st linearly polarized light light which carried out outgoing radiation from the image display section 1000 penetrates the reflective mold polarization selection member 300, and it carries out incidence to the transparency polarization shaft variant part 400.

[0164] The image light 3001 which passes the transparency polarization shaft variant part 400 changes from the 1st linearly polarized light light to the 2nd linearly polarized light light. Incidence of the image light 3001 which penetrated the transparency polarization shaft variant part 400 is carried out to the reflective mold polarization selection member 301. Although the reflective mold polarization selection member 301 carries out specular reflection of the 1st linearly polarized light component, since it penetrates the 2nd linearly polarized light component, the image light 3001 which changed with transparency polarization shaft variant parts 400 to the 2nd linearly polarized light light penetrates the reflective mold polarization selection member 301, and it carries out incidence to the adjustable polarization selection member 600. Although the adjustable polarization selection member 600 is an OFF state and the linearly polarized light component of [ 1st ] the light which carries out incidence to this is absorbed when this display is in an image display condition, the 2nd linearly polarized light component is penetrated. Therefore, the image light 3001 penetrates the adjustable polarization selection member 600, and is observed by the observer.

[0165] On the other hand, the adjustable polarization selection member 600 is an OFF state, although the outdoor daylight 3002 which faces to a display from an observer side (left-hand side in drawing) is unpolarized light, when a display is in an image display condition, the 1st linearly polarized light component is absorbed and only the 2nd linearly polarized light component penetrates the light which carries out incidence to this for it. In case the outdoor daylight 3002 which penetrated the adjustable polarization selection member 600 penetrates the reflective mold polarization selection member 301 and penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, also penetrates the reflective mold polarization selection member 300, and hardly returns to an observer side toward the image display section 1000.

[0166] Therefore, in the state of image display, since the image light 3001 which carried out outgoing radiation from the image display section 1000 turns on an observer, without losing almost, it can obtain a bright image. Furthermore, since outdoor daylight 3002 is hardly reflected with a display, degradation of the image quality resulting from outdoor daylight, such as reflected and a fall of a contrast ratio, does not take place.

[0167] Drawing 21 shows the case where this display is in a mirror condition. When this display is in a mirror condition, the transparency polarization shaft variant part 400 impresses an electrical potential difference to the liquid crystal layer 407 which constitutes this, and is taken as an ON state. Also let the adjustable polarization selection member 600 be an ON state.

[0168] Also in this case, outgoing radiation is carried out from the image display section 1000, and incidence of the image light 3001 corresponding to the clear display which penetrated the reflective mold polarization selection member 300 is carried out to the transparency polarization shaft variant part 400. Since it penetrates with the 1st linearly polarized light light, it reflects by the reflective mold polarization selection member 301 and the image light 3001 which penetrates the transparency polarization shaft variant part 400 at this time returns to the image display section 1000, without a polarization shaft changing, it is not observed by the observer.

[0169] On the other hand, since the adjustable polarization selection member 600 is an ON state and the outdoor daylight 3002 which faces to a display from an observer side will be in a transparent condition to almost all the polarization component when a display is in a mirror condition, as for outdoor daylight 3002, the most penetrates the adjustable polarization selection member 600. Incidence of the outdoor daylight 3002 which penetrated the adjustable polarization selection member 600 is carried out to the reflective mold polarization selection member 301. The 2nd linearly polarized light component penetrates the reflective mold polarization selection member 301 among the outdoor daylight 3002 which carried out incidence to the reflective mold polarization selection member 301, it is reflected by the reflective mold polarization selection member 301, and the 1st linearly polarized light component goes the adjustable polarization selection member 600 to a transparency ******** side again. The transparency polarization shaft variant part 400 penetrates without changing, a polarization shaft is reflected by the reflective mold polarization selection member 300, a transparency polarization shaft variant part 400, and the reflective mold polarization selection member 301 and the adjustable polarization selection member 600 penetrate again, and the 2nd [ penetrated / on the other hand / among the outdoor daylight 3002 which carried out incidence to the reflective mold polarization selection member 301 / the reflective mold polarization selection member 301 ] linearly polarized light component is the other side to an observer side.

[0170] That is, in the case of a mirror condition, it reflects by the reflective mold polarization selection member 301, and since the image light 3001 returns to the image display section 1000, it is not observed by the observer. Moreover, since almost all the polarization component is reflected by the 1st reflective mold polarization selection member 300 and the reflective mold polarization selection member 301, outdoor daylight 3002 functions as a very bright mirror by them.

[0171] In addition, like the above-mentioned example 1, when changing a display into a mirror condition also in this example, the applicable part of the image display section 1000 is made a dark display, or it can be made the configuration which is interlocked with the above-mentioned actuation and performs switching off the lighting system 100 which constitutes an image display member. In this case, since image light is not outputted from the image display section 1000, when the unnecessary stray light turning on an observer and spoiling the engine performance of a mirror is lost and it switches off especially the lighting system 100, it is effective in the ability to reduce power consumption in a mirror condition.

[0172] With the display of this example, the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 are effectually switched to a transparent condition and the condition of functioning as a mirror by control of the polarization absorption of light by the adjustable polarization selection member 600, and control of the polarization condition by the transparency polarization shaft variant part 400, as above-mentioned. Therefore, a bright image is obtained by making effectually the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 into a transparent condition in the state of image display, and since outdoor daylight is hardly reflected with a display even if it is a still brighter environment in a perimeter, degradation of the image quality of the fall of reflected [ like / in the case of using a half mirror ] and the contrast ratio accompanying it does not arise. That is, a switch of an image display condition and a mirror condition can be realized, without deteriorating the mutual engine performance.

[0173] When a display is especially in a mirror condition in this example, the adjustable polarization selection member 600 will be in a transparence condition, and since almost all the polarization component is reflected by the reflective mold polarization selection member 301 and the reflective mold polarization selection member 300, outdoor daylight is further effective [ with the member ] in a twice [ more than ] as many, very bright mirror as the display of an example 1 being realizable.

[0174] In addition, since interface reflection of each part material which constitutes this display is reduced, it is also possible to make each part material the configuration optically combined with the transparent binder with which the refractive index was doubled.

[0175] in addition -- although the dielectric anisotropy used forward liquid crystal for the nematic liquid crystal and was considering as homogeneous orientation as a liquid crystal layer 607 of the adjustable polarization selection member 600 in the above-mentioned example at it -- liquid crystal negative [ as a nematic liquid crystal of the liquid crystal layer 607 ] in a dielectric anisotropy -- using -- an initial state (electric-field condition of not impressing) -- setting -- the direction of a liquid crystal molecule major axis -- a transparence substrate -- receiving -- abbreviation -- what was made into the homeotropic orientation which becomes perpendicular can also be used. In this case, although the direction of orientation of a liquid crystal molecule major axis changes horizontally perpendicularly to two transparence substrates 601 and 602, it is good [ the direction ], when an electrical potential difference is impressed to the transparent electrodes 603 and 606 of two transparence substrates 601 and 602 and electric field are impressed to the liquid crystal layer 607 to attach few pre tilt angles to the initial orientation condition of liquid crystal so that a liquid crystal molecule may carry out orientation in the fixed direction.

[0176] A dielectric anisotropy uses negative liquid crystal as a nematic liquid crystal of the liquid crystal layer 607. The condition that there is no potential difference among the transparent electrodes 603 and 606 of two transparence substrates 601 and 602, and electric field are not impressed to the liquid crystal layer 607 when it considers as a homeotropic orientation, That is, in an OFF state, since the direction of the molecule major axis serves as an abbreviation perpendicular to the transparence substrate, is also taught dichroic coloring matter by this and orientation of the nematic liquid crystal of the liquid crystal layer 607 is carried out, the incident light from the outside is

penetrated, without absorbing almost in the liquid crystal layer 607.
[0177] The direction of orientation of the molecule major axis of a nematic liquid crystal changes horizontally perpendicularly to two transparence substrates 601 and 602, and the direction of orientation of dichroic coloring matter also changes horizontally in the condition which impressed the electrical potential difference to the transparent electrodes 603 and 606 of two transparence substrates 601 and 602, and impressed electric field to the liquid crystal layer 607 on the other hand, i.e., an ON state, in connection with this. dichroic coloring matter -- a molecule shaft -- abbreviation -- it has an parallel absorption polarization shaft, and a polarization component parallel to a molecule shaft is absorbed strongly, and the polarization component which intersects perpendicularly with this has the property in which it hardly absorbs. For this reason, in case the incident light from the outside passes the liquid crystal layer 607, the linearly polarized light component which has the oscillating direction of an electric vector in the direction parallel to the molecule shaft of dichroic coloring matter is absorbed, and the linearly polarized light component which intersects perpendicularly with this is penetrated.
[0178] That is, if the direction of orientation of the liquid crystal in the condition of having impressed electric field to the liquid crystal layer 607 is made in agreement with the polarization shaft of the 1st linearly polarized light, the linearly polarized light component of [ 1st ] the light which carried out incidence is absorbed, and the 2nd linearly polarized light component can realize a selectable adjustable polarization selection member for either condition of the condition of penetrating, and the condition that all polarization components penetrate.
[0179] In addition, this example 2 described the case where the adjustable polarization selection member 600 was arranged to the observer side of the reflective mold polarization selection member 301. An adjustable polarization selection member is an important member which controls unnecessary reflection of the outdoor daylight in the reflective mold polarization selection member 301 in the state of image display, will be in a transparent condition effectually in the state of a mirror, and contributes to the improvement in brightness of a mirror. However, this invention does not except the configuration which does not arrange the adjustable polarization selection member 600 to the observer side of the reflective mold polarization selection member 301, when various applications are taken into consideration. In this case, although outdoor daylight may reflect by the reflective mold polarization selection member 301 and an image may become hard to see in the state of image display, since there was no member which checks reflection of the outdoor daylight in a reflective mold polarization selection member and the reflective mold polarization selection member 301 in a mirror condition, 80% or more of very high reflection factor was obtained. This reflection factor is brightness which is equal to the mirror in which the thin film of aluminum was formed on the glass substrate, and can realize the mirror of brightness equivalent to a common mirror.
[0180] (Mirror area size) Here, when it is a main application that an observer projects his face in the case of a mirror condition, and the display of an example 1 and an example 2 observes at it, it asks for the size of a desirable mirror field. If the average of an adult man's total face height takes into consideration that the average of 234.6mm and head width is width of face of 156.4mm (human-engineering criteria numeric-value formula handbook; 1992, Gihodo Shuppan), height of 117.3mm and the magnitude beyond width-of-face 78.2mm are required as magnitude of a mirror to project the whole face on a mirror, without an observer changing an observation location.
[0181] The display of this invention is performing the switch of an image display condition and a mirror condition in (the example 2) in (the example 1) with the transparency polarization shaft variant part 400 again by the transparency polarization shaft variant part 400 and the adjustable polarization selection member 600. Therefore, in order to realize the mirror field of the above-mentioned magnitude, being formed continuously is desirable [ the transparent electrode 403,406 formed in two transparence substrates 401,402 which constitute the transparency polarization shaft variant part 400, respectively and the transparent electrodes 603 and 606 formed in two transparence substrates 601 and 602 of the adjustable polarization selection member 600, respectively ], without being missing to the field of 117.3 mm height and 78.2 or more mm of width of face at least. Because, although the part with a transparent electrode will function as a mirror supposing division formation of the transparent electrode is carried out, for example by this field within the limits, it is because the clearance between transparent electrodes does not function as a mirror, but this gap is

observed in the shape of a muscle and the engine performance satisfactory as a mirror is no longer obtained.

[0182] In addition, when using the display of an example 1 and an example 2 for pocket devices, such as a cellular phone and a Personal Digital Assistant, the magnitude of a display itself may not fulfill height of 117.3mm of the above-mentioned mirror size, and width of face of 78.2mm. Then, the whole face is not projected but the size of a mirror of the magnitude suitable for using it for correcting makeup partially or checking the contact lens in an eye etc. can be obtained. In this case, what is necessary is just to make it the magnitude in which the quadrant of a face is reflected in a mirror. It is desirable to specifically make it height of 58.6mm and width of face of 39.1mm or more as magnitude of a mirror.

[0183] Therefore, as for the transparent electrode 403,406 formed in two transparence substrates 401,402 which constitute the transparency polarization shaft variant part 400, respectively, and the transparent electrodes 603 and 606 formed in two transparence substrates 601 and 602 of the adjustable polarization selection member 600, respectively, being formed continuously is desirable, without being missing to the field of 58.6 mm height and 39.1 or more mm of width of face at least.

[0184] (Example 3) In the display of the example 1 mentioned above and an example 2, although it was a configuration using the liquid crystal display panel which has arranged the lighting system at the rear face as the image display section 1000 which makes the 1st linearly polarized light image light, and carries out outgoing radiation, this invention is not limited to this.

[0185] As the image display section 1000 which makes linearly polarized light light image light, and carries out outgoing radiation, the tooth-back projection mold display which used the liquid crystal display panel for others as a two-dimensional optical switching device can be used. Using a tooth-back projection mold display as the image display section 1000 of the display explained in the example 1, an example 3 attaches the same sign to the same section as an example 1, and omits detailed explanation.

[0186] Like drawing 22 , this display consists of a transparency mold screen 703, a projection device 701, and a mirror 702, and has the structure where the incident light 704 which carried out outgoing radiation from the projection device 701 is irradiated by the transparency mold screen 703 through a mirror 702. The transparency mold screen 703 contains the reflective mold polarization selection member 300 of an example 1, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500.

[0187] The liquid crystal projection device which used the liquid crystal display panel as a two-dimensional optical switching device can be used for a projection device 701. What carries out outgoing radiation of the linearly polarized light whose polarization condition of each colored light corresponded as incident light is used for a projection device 701. Furthermore, the image light 704 by which outgoing radiation is carried out from a projection device 701 is constituted so that it may become s-polarized light light or p-polarized light light to the reflector of a mirror 702. It is because phase contrast produces the light which generally carries out incidence of this to a reflector of an s-polarized light component and a p-polarized light component to a reflector, so the polarization condition will change if polarization light other than s-polarized light light or p-polarized light light carries out incidence to a reflector.

[0188] A mirror 702 can use for **** clear glass [ target / optical ] what vapor-deposited silver or a reflexibility metal like aluminum.

[0189] The transparency mold screen 703 has composition which has arranged the Fresnel lens sheet 1402, the lenticular lens sheet 1401, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 in this order as it is shown in drawing 23 . The Fresnel lens sheet 1402 is an optic which carries out the same operation as a convex lens, and serves to bend the direction of the chief ray from a projection device 701 to an observer side, and to extend the **** range. The lenticular lens sheet 1401 carries out the operation which carries out the luminous intensity distribution of the incident light bundle restricted from the projection device 701 effective in the observation range of an observer. Thereby, a bright image can be obtained.

[0190] An example of the lenticular lens sheet 1401 which can be used for drawing 24 and drawing 25 by this example is explained. The lenticular lens sheet 1401 arranges two or more cylindrical-lens-like lenses 1501 to an one direction, has the composition of having formed the black stripe 1502 in parts other than the condensing section of light, by making the focal location of a lens 1501 into an observation side, does not have loss of incident light ideally and has composition which can control the fall of the contrast ratio to outdoor daylight. Generally, a lenticular lens sheet is arranging the bus-bar so that it may become perpendicularly to the screen, and a horizontally large angle of visibility is obtained.

[0191] In addition, as for the Fresnel lens sheet 1402 and the lenticular lens sheet 1401, it is desirable for form birefringence to use the injection-molded product using a small member, for example, acrylic resin, so that turbulence of polarization of the incident light 704 from a projection device 701 may both become small as much as possible.

[0192] Since the reflective mold polarization selection member 300 is an important member which functions as a reflector of a mirror as it was already described, there is rigidity, and it is flat and can be made the configuration which stuck with the binder on **** transparent substrates [ target / optical ], for example, the acrylic resin plate with a thickness of about 3mm which carried out injection molding, and was united with it so that it may not be distorted.

[0193] Each shaft orientation of the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 arranges the incident light 704 which carries out outgoing radiation from a projection device 701 and which carries out incidence to the transparency mold screen 703 so that it may act as the 1st linearly polarized light as the example 1 described.

[0194] Next, actuation of this display is explained. Here, the absorption mold polarization selection member 500 absorbs the 1st linearly polarized light component, and the 2nd linearly polarized light component explains the case where it penetrates.

[0195] Since this display is constituted from the same member as an example 1 except having used the tooth-back projection mold display for the image display member, actuation also becomes the same. That is, when this display is in an image display condition, it reflects by the mirror 702 and incidence of the image light 704 which carried out outgoing radiation from the projection device 701 is carried out to the transparency mold screen 703. According to an operation of Fresnel lens 1402 and the lenticular lens 1401, the image light 704 which carried out incidence to the transparency mold screen 703 penetrates the reflective mold polarization selection member 300 with breadth effective in the observation range of an observer, and it carries out incidence to the transparency polarization shaft variant part 400. When this display is in an image display condition, the image light 704 which passes the transparency polarization shaft variant part 400 changes from the 1st linearly polarized light light to the 2nd linearly polarized light light, penetrates the absorption mold polarization selection member 500, and is observed by the observer.

[0196] On the other hand, although the outdoor daylight which faces to this display from an observer side is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed and only the 2nd linearly polarized light component penetrates it. In case the outdoor daylight which penetrated the absorption mold polarization selection member 500 penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the reflective mold polarization selection member 300, and hardly returns to Fresnel lens 1402, the lenticular lens 1401, and a pan toward a projection device 701 to an observer side through a mirror 702.

[0197] Therefore, in the state of image display, outgoing radiation is carried out from a projection device 701, and since the image light 704 which passed Fresnel lens 1402 and the lenticular lens 1401 turns on an observer, without losing almost, it can obtain a bright image. Furthermore, since outdoor daylight is hardly reflected with a display, degradation of the image quality resulting from outdoor daylight called the fall of reflected or a contrast ratio does not take place.

[0198] When this display is in a mirror condition, incidence of the image light 704 which carried out outgoing radiation is carried out to the transparency mold screen 703 through a mirror 702 from a projection device 701. According to an operation of Fresnel lens 1402 and the lenticular lens 1401, the image light 704 which carried out incidence to the transparency mold screen 703 penetrates the reflective mold polarization selection member 300 with breadth effective in the observation range of an observer, and it carries out incidence to the transparency polarization shaft variant part 400. When a display is in a mirror condition, since the image light 704 which penetrates the transparency polarization shaft variant part 400 is penetrated with the 1st linearly polarized light light and absorbed by the absorption mold polarization selection member 500, without a polarization shaft changing, it is not observed by the observer.

[0199] On the other hand, although the outdoor daylight which faces to a display from an observer side is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed, and only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. The outdoor daylight which carried out incidence to the transparency polarization shaft variant part 400 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light light, without a polarization shaft changing, and results in the reflective mold polarization selection member 300. In order that the reflective mold polarization selection member 300 may penetrate the 1st linearly polarized light component and may carry out specular reflection of the 2nd linearly polarized light component, outdoor daylight reflects it by the reflective mold polarization selection member 300. The outdoor daylight reflected by the reflective mold polarization selection member 300 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light light, without a polarization shaft changing, also penetrates the polarization selection member 500, and turns on an observer.

[0200] Therefore, in the state of a mirror, ideally, since the light of the one half of unpolarized light reflects by the reflective mold polarization selection member 300 and goes to an observer side, the outdoor daylight which the image light 704 is absorbed by the absorption mold polarization selection member 500, does not result in an observer, and carries out incidence to a display functions as a bright mirror.

[0201] In addition, when changing this display into a mirror condition, in the field applicable to the field which will be in a mirror condition, the image of a projection device 701 is made a dark display. In this case, since it hardly leaks and an unnecessary light does not turn on an observer, the image light from a projection device 701 is effective in the mirror condition that a reflected image with a high contrast ratio is acquired being realizable.

[0202] Moreover, although the above-mentioned explanation showed the case where the absorption mold polarization selection member 500 penetrated the 2nd linearly polarized light component, and the 1st linearly polarized light component was absorbed, the absorption mold polarization selection member 500 may penetrate the 1st linearly polarized light component, and the 2nd linearly polarized light component may use what is absorbed. In this case, when the power consumption of a display is 0, it can be made to function as a mirror.

[0203] Moreover, in this example, it considered as the configuration which has arranged the Fresnel lens sheet 1402, the lenticular lens sheet 1401, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 in this order as the transparency mold screen 703 was shown in drawing 23 . However, it is good also as a configuration which has arranged the Fresnel lens sheet 1402, the lenticular lens sheet 1401, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, the reflective mold polarization selection member 301, and the adjustable polarization selection member 600 for the transparency mold screen 703 in this order as it is independently indicated in drawing 26 as this configuration. In this case, it means using a tooth-back projection mold display for the image display section 1000 of the display explained in the example 2, and the same actuation as explanation in the example 2 and an operation are acquired.

[0204] Moreover, it is good also as a configuration which removes a mirror function part for a mirror function part from optical system as removable structure among the mirror function part (the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, the reflective mold polarization selection member 301, and adjustable polarization selection member 600) which constitutes the transparency mold screen 703 of this example, and optical system (the Fresnel lens sheet 1402 and lenticular lens sheet 1401) when a mirror function is unnecessary. Or it is also possible to consider as the configuration which constitutes the screen equipped with the mirror function part independently excluding the image display section, and

equips the display of arbitration with this mirror functional screen if needed.
[0205] (Example 4) The display of the example 4 of this invention is explained using drawing 27 and drawing 28 . the transparence substrates 401 and 402 (refer to drawing 16 ) of the display which explained this example 4 in the example 2 -- a conductive metal -- a line -- a pattern -- 1000 -- the pitch of hundreds of A -- forming -- these metals -- a line -- it considers as the configuration in which the function of the reflective mold polarization selection member 301, a transparent electrode 403, and the reflective mold polarization selection member 300 and a transparent electrode 406 is made to use also [ pattern ]. Therefore, the same sign is attached to the same section as the above-mentioned explanation, and detailed explanation is omitted.
[0206] At this example 4, the metal wire-like pattern of aluminum is formed in the transparence substrates 401 and 402 of the transparency polarization shaft adjustable means 400 in the pitch of 100A more than 1000. in this case, a metal -- a line -- the light which carries out incidence to a pattern -- a metal -- a line -- in order to penetrate the linearly polarized light component of the direction which reflects a linearly polarized light component parallel to the longitudinal direction of the line of a pattern, and intersects perpendicularly with this -- a metal -- a line -- a pattern functions as a reflective mold polarization selection member. moreover, these adjacent lines -- connecting some patterns electrically -- potential -- the same or abbreviation -- since it can change into the same condition, it can be made to function also as a transparent electrode which penetrates a specific linearly polarized light component That is, a metal wire-like pattern makes the function of a reflective mold polarization selection member and a transparent electrode serve a double purpose. in addition, an adjacent line -- it is made to make electric connection of patterns in locations other than mirror fields, such as the periphery section, so that it may not have a bad influence on the function of a reflective mold polarization selection member.
[0207] here -- the transparency polarization shaft variant part 400 -- drawing 27 -- like -- a metal -- a line -- the 1st transparence substrate 401 with which laminating formation of the orientation film 404 which consists of a pattern 311 and a polyimide system macromolecule was carried out extensively -- the same -- a metal -- a line -- a pattern 310 and the orientation film 405 contain the 2nd transparence substrate 402 and liquid crystal layer 407 by which laminating formation was carried out extensively.
[0208] It connects with the power source through wiring which is not illustrated and a switching element, and the metal wire-like patterns 311 and 310 formed in two transparence substrates 401,402, respectively are constituted selectable in either condition of the condition of not impressing an electrical potential difference to the metal wire-like patterns 311 and 310, and the condition of impressing an electrical potential difference. that is, a metal -- a line -- the condition that there is no potential difference in patterns 311 and 310, and electric field are not impressed to the liquid crystal layer 407, and a metal -- a line -- one condition of the conditions that impress an electrical potential difference to patterns 311 and 310, and electric field are impressed to the liquid crystal layer 407 is constituted selectable. Moreover, the longitudinal direction of the line of the metal wire-like patterns 310 and 311 is constituted and arranged so that it may intersect perpendicularly with each other.
[0209] The liquid crystal layer 407 arranges two transparence substrates 401,402 so that the forming face of the orientation film 404 and 410 may face each other, prepares a fixed gap between two transparence substrates 401 and 402 by inserting the spacer which is not illustrated further, carries out the seal of the perimeter of this gap to the shape of a frame by the sealant 410, forms space, and constitutes it from a dielectric anisotropy enclosing a forward nematic liquid crystal with this space.
[0210] Drawing 28 is the explanatory view of the shaft orientation of each part material of this example. In addition, the display of the include angle of each shaft is shown at an angle of the circumference of a reverse clock from here on the basis of the location at 3:00 of an image display side horizontal direction. The transparency polarization shaft of the linearly polarized light of the absorption mold polarization selection member (polarizing plate) 208 of TN liquid crystal display panel 200 which constitutes the image display section 1000 is made into 135 degrees as shown in drawing 28 . therefore, the metal which functions as a reflective mold polarization selection member -- a line -- the transparency polarization shaft of the linearly polarized light of a pattern 310 similarly the transparence substrate 402 side of 135 degrees and the transparency polarization shaft variant part 400 The direction of orientation of the liquid crystal molecule major axis by the side of the

transparence substrate 401, respectively 135 degrees and 45 degrees, the metal which functions as a reflective mold polarization selection member -- a line -- the transparency polarization shaft of the linearly polarized light of a pattern 311 makes 135 degrees both the directions of orientation of the liquid crystal molecule major axis by the side of the transparence substrate 602 of 45 degrees and the adjustable polarization selection member 600, and the transparence substrate 601.

[0211] the above-mentioned configuration -- the display of this example 4 -- a metal -- a line -- a pattern 310 -- the function of the reflective mold polarization selection member 300 of an example 2, and an electrode 406 -- achieving -- a metal -- a line -- in order that a pattern 311 may achieve the function of the reflective mold polarization selection member 301 of an example 2, and an electrode 403, the display of this example 4 operates like the display of an example 2, and the same effectiveness is acquired.

[0212] In addition, when a display is made into a mirror condition, the reflective mold polarization selection member 300,301 is a member which functions as a reflector, as the example 2 described. For this reason, since parallax will arise in the image reflected by each of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 if spacing of the reflective mold polarization selection member 300 and the reflective mold polarization selection member 301 becomes large, as for both spacing, it is desirable for it to be necessary to make it as small as possible, and to be referred to as 0.11mm or less practical. the metal which functions as a reflective mold polarization selection member 300 especially in this example 4 -- a line -- the metal which functions as a pattern 310 as a reflective mold polarization selection member 301 -- a line -- since the about several micrometers liquid crystal layer 407, and the less than 1-micrometer orientation film 404 and the thin film of 410 grades are only between patterns 311, 10 micrometers is not filled with both spacing, either. For this reason, the effectiveness that the high-definition mirror which does not have parallax brightly is realizable is acquired.

[0213] Moreover, since the metal wire-like pattern 310,311 is formed on substrates, such as flat glass, it cannot receive change of environments, such as temperature and humidity, easily, and is effective in the mirror which the distortion by environmental change cannot generate easily being realizable.

[0214] moreover -- this invention -- a metal -- a line -- what can obtain reflection with a pattern 310,311 uniform in the range of the light -- it is -- ****ing -- a line -- neither especially the concrete structure of a pattern, nor a pitch, pattern height, etc. are limited. Moreover, the metal wire-like pattern formed with chromium, silver, etc. in addition to aluminum may be used.

[0215] (An example 5) The case have arranged the mirror function part which turns into the upper part of the image-display section 1000 which makes the 1st linearly polarized light image light, and carries out outgoing radiation in the above-mentioned example 1 - the example 4 from a reflective mold polarization selection member 300, a transparency polarization shaft variant part 400, and a polarization selection member 500, or the mirror function part become from the reflective mold polarization selection member 300, a transparency polarization shaft variant part 400, a reflective mold polarization selection member 301, and an adjustable polarization selection member 600 explained. Even if the mirror function part is not arranged in these cases, image display is possible for it, and the image display section 1000 makes a mirror function part an attachment-and-detachment type depending on the purpose of using a device, and when a mirror function is unnecessary, it can improve convenience, such as removing a mirror function part.

[0216] However, this invention is not limited to these. That is, when there is a mirror function part, you may be a configuration to which image display becomes possible, or the configuration of a mirror function part and an image display member which shared the configuration in part.

[0217] The display of an example 5 is explained using drawing 29 . Since there are many intersections with an example 1 (for example, refer to drawing 8 ), this example 5 attaches the same sign to the same member as an example 1, and omits detailed explanation.

[0218] This display removes the absorption mold polarization selection member 208 by the side of an observer (polarizing plate) for red and the green and blue three primary colors from the image display section 1000 in the display explained in the example 1, using what can irradiate time sharing as a lighting system 100. Therefore, when the mirror function part which consists of the reflective mold polarization selection member 300, a transparency polarization shaft variant part 400, and an absorption mold polarization selection member 500 is removed, the liquid crystal display panel 200 of this example cannot display a clear image.

[0219] In the liquid crystal display panel 200 of an example 1, the liquid crystal display panel 200 of this example removed the absorption mold polarization selection member (polarizing plate) 208, and also lost the color filter, and it made it what can accelerate the response of liquid crystal so that it could respond to a field sequential color display method.

[0220] As for the field sequential color display method, the technical detail is indicated by JP,5-19257,A, JP,11-52354,A, etc. This method realizes the display of a color picture by irradiating a liquid crystal display panel by time sharing, synchronizing the illumination light in three primary colors with it, and driving liquid crystal. That is, in order for a liquid crystal display panel to perform the display of one frame, since it is necessary to indicate the three subframes corresponding to the three primary colors by sequential, liquid crystal needs to answer a high speed more. What is necessary is to use the big liquid crystal of birefringence deltan, in order to satisfy the conditions of the above-mentioned wave guide, when using TN mode, and just to constitute the thickness of the liquid crystal layer 207 thinly with about 2 micrometers, in order to make the response of liquid crystal quick so that it may correspond to a field sequential color display method.

[0221] In addition, although this example explains the case in TN mode hereafter, if it is the configuration that the response characteristic corresponding to a field sequential color display method is acquired, the liquid crystal display panel of this invention will not be limited to the above-mentioned configuration.

[0222] A lighting system 100 consists of the transparent material 193 which consists of a transparence medium, the red arranged to the end face of a transparent material 193 and the light source 190 which carries out outgoing radiation of the green and blue light in three primary colors, a polarization maintenance reflective sheet 192 arranged at the rear face of a transparent material 193, and the polarization maintenance diffusion section 191 arranged in the front face of a transparent material 193.

[0223] Red and LED (Light Emitting Diode) which unified three chips which emit light in each colored light in three primary colors as the light source 190 which carries out outgoing radiation of the green and blue light in three primary colors can be used. Such LED is put on the market from Nichia Chemical Industries, Ltd.

[0224] A transparent material 193 equips a rear face (near field of the liquid crystal display panel 200 and the contrary) with the inclination reflector 194 which consisted of transparent acrylic resin and consisted of the concave convexes or level differences of a large number which have the detailed inclined plane which emits light to the liquid crystal display panel 200 side by changing whenever [ angle-of-reflection / of the configuration which confines in the interior the light which carried out incidence from the end face by total reflection, and the light which spreads the interior ]. Since this mentions later, it is for maintaining the polarization condition of the light which carries out incidence to a transparent material 193 from the liquid crystal display panel 200 side.

[0225] Although it is desirable to consider as a specular reflection side by metal thin films, such as aluminum and silver, or dielectric multilayers as for the inclination reflector 194, even if it is not limited to these and does not give such a special reflective member, the reflex function needed by the difference of the refractive index of air and acrylic resin shall be filled.

[0226] Here, the inclination reflector 194 was made into 41 degrees whenever [ average pitch 200micrometer, average height / of 10 micrometers /, and average tilt-angle ]. In addition, change the height of the inclination reflector 194 continuously so that it may be low in the place near the light source 190 and may become high in a location distant from the light source 190. Or whenever [ pitch / of the inclination reflector 194 / or tilt-angle ] is continuously changed with the distance from the light source 190, or it constitutes so that it may become thin, and you may make it raise the homogeneity of the light which carries out outgoing radiation from a transparent material 193 as the thickness of a transparent material 193 is separated from the light source 190.

[0227] In addition, yes [ if the configuration of a transparent material 193 carries out abbreviation maintenance of the polarization condition of the light which carries out incidence to a transparent material 193 from the liquid crystal display panel 200 side, it is limited to this configuration, and ].

[0228] The polarization maintenance reflective sheet 192 forms the reflector which maintains a polarization condition on base materials, such as a glass plate, a resin plate, and a resin film, and has the function to reflect in the liquid crystal display panel 200 side the light which has returned from the liquid crystal display panel 200 side to the lighting system 100, maintaining the polarization condition again. With the reflector which maintains the polarization condition described here, at least to vertical-incidence light, linearly polarized light light reflects with the same linearly polarized light light, and the circular polarization of light is a reflector reflected as the circular polarization of light with the reverse hand of cut. The specular reflection side by the thing which specifically put metal thin films, such as aluminum and Ag, on the base material as a reflector, or the dielectric multilayers constituted so that a high reflection factor might be obtained to the wavelength band of light source light is used.

[0229] The polarization maintenance diffusion section 191 is for equalizing the outgoing radiation angular distribution of the light which carried out outgoing radiation from the transparent material 193, and the luminance distribution in a field, and the polarization condition of the light which passes this further carries out abbreviation maintenance. As the polarization maintenance diffusion section 191, two or more spherical transparence beads can be densely arranged in in the shape of a field on a **** transparence [ target / optical ] base material, and LCG (light control glass) of a publication etc. can be used for the hologram diffusion plate formed on the **** transparence [ target / the thing fixed by transparent resin, or / optical ] base material or SPIE, Vol.1536, Optical Materials Technology for Energy Efficiency and Solar Energy Conversion X (1991), and pp 138-148.

[0230] Drawing 30 is the explanatory view of the shaft orientation of each part material of this example. Since when TN liquid crystal display panel is used acquires the horizontal symmetric property of a viewing-angle property as a liquid crystal display panel 200 as illustration, the transparency polarization shaft of the linearly polarized light of a polarizing plate 209 usually makes it into 45 degrees or 135 degrees (this example 45 degrees). Making the liquid crystal orientation shaft by the side of the transparence substrate 202, and the liquid-crystal orientation shaft by the side of the transparence substrate 201 into 45 degrees and 135 degrees, respectively, as for the direction of orientation of the liquid crystal molecule major axis by the side of the transparence substrate 402 of 135 degrees and the transparency polarization shaft variant part 400, and the transparence substrate 401, the transparency polarization shaft of the linearly polarized light of 135 degrees, 45 degrees, and the absorption mold polarization selection member 500 makes 45 degrees the transparency polarization shaft of the linearly polarized light of the reflective mold polarization selection member 300, respectively.

[0231] Next, actuation of this example is explained. Incidence of the light which carried out outgoing radiation from the light source 190 is carried out to a transparent material 193, and it spreads the transparent material 193, repeating total reflection. The light which reached the inclination inclined plane 194 among the light which spreads a transparent material 193 changes the travelling direction, and carries out outgoing radiation from the front-face side of a transparent material 193. The light which carried out outgoing radiation from the transparent material 193 is irradiated by the liquid crystal display component 200 after outgoing radiation angular distribution and the luminance distribution in a field are equalized by the polarization maintenance diffusion section 191.

[0232] Although the linearly polarized light light which penetrated the polarizing plate 209 among the light irradiated by the liquid crystal display panel 200 passes the liquid crystal layer 207 and it carries out incidence to the reflective mold polarization selection member 300, the polarization condition of the light which penetrates the liquid crystal layer 208 can be changed with the electrical potential difference impressed to the liquid crystal layer 207 in this case. For this reason, by impressing the electrical potential difference corresponding to the image information told from the image information generating section to the transparence substrate 202 and the transparent electrodes 203 and 205 on 201, and impressing electric field to the liquid crystal layer 207, the polarization condition of the light which passes the liquid crystal layer 207 can be changed, and the optical image which consists of linearly polarized light light can be formed by controlling the quantity of light which penetrates the reflective mold polarization selection member 300. That is, the reflective mold polarization selection member 300 of this example will make the function of the absorption mold polarization selection member (polarizing plate) 208 arranged to the observer side of the liquid crystal display panel 200 in an example 1 serve a double purpose.

[0233] Incidence of the image light which penetrated the reflective mold polarization selection member 300 is carried out to the transparency polarization shaft variant part 400. When this display is in an image display condition, the transparency polarization shaft variant part 400 carries out to the condition, i.e., an OFF state, of not impressing an electrical potential difference to the liquid crystal layer 407 which constitutes this.

[0234] Here, if the linearly polarized light component which penetrates the reflective mold polarization selection member 300 is used as the 1st linearly polarized light component and the linearly polarized light component a component and this and a polarization shaft cross at right angles is used as the 2nd linearly polarized light component, the image light which passes the transparency polarization shaft variant part 400 will change from the 1st linearly polarized light light to the 2nd linearly polarized light light. Incidence of the image light which penetrated the transparency polarization shaft variant part 400 is carried out to the absorption mold polarization selection member 500. Since the absorption mold polarization selection member 500 absorbs the 1st linearly polarized light component and the 2nd linearly polarized light component penetrates, the image light 3001 which changed with transparency polarization shaft variant parts 400 to the 2nd linearly polarized light light penetrates the absorption mold polarization selection member 500, and is observed by the observer.

[0235] When this display is in a mirror condition, the transparency polarization shaft variant part 400 impresses electric field to the liquid crystal layer 407 which constitutes this, and is taken as an ON state. Since image light will leak to an observer side if the lighting system 100 is on, since there is no absorption mold polarization selection member (polarizing plate) 208 prepared as an absorption mold polarization selection member in the above-mentioned example in this display at this time, the contrast ratio of a reflected image falls and a legible mirror cannot be realized. Therefore, in the case of a mirror condition, a lighting system 100 is switched off. Since lighting and putting out lights are made to a high speed by using LED as the light source 190 of a lighting system 100 in the case of this example, a mirror condition and an image display condition are changed to a high speed to the extent that they do not make an observer sense stress.

[0236] On the other hand, in case the outdoor daylight which faces to this display from an observer side penetrates the absorption mold polarization selection member 500, the 1st linearly polarized light component is absorbed, and only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. The outdoor daylight which carried out incidence to the transparency polarization shaft variant part 400 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, and results in the reflective mold polarization selection member 300. In order that the reflective mold polarization selection member 300 may penetrate the 1st linearly polarized light component and may carry out specular reflection of the 2nd linearly polarized light component, outdoor daylight 3002 reflects it by the reflective mold polarization selection member 300. The outdoor daylight 3002 reflected by the reflective mold polarization selection member 300 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, also penetrates the absorption mold polarization selection member 500 further, and turns on an observer.

[0237] Therefore, in order to switch off a lighting system in the state of a mirror, image light does not result in an observer, and since the light of the one half of unpolarized light reflects by the reflective mold polarization selection member 300 and goes to an observer side ideally among outdoor daylight, the display of this example functions as a bright mirror.

[0238] In addition, there is the following characteristic effectiveness in this example.

[0239] Drawing 31 is drawing for explaining effectiveness peculiar to this example. Here, if the linearly polarized light component which penetrates the reflective mold polarization selection member 300 is used as the 1st linearly polarized light component and the linearly polarized light component a component and this and a polarization shaft cross at right angles is used as the 2nd linearly polarized light component, a polarizing plate 209 will penetrate the 2nd linearly polarized light component.

[0240] In this display, as above-mentioned, the 2nd linearly polarized light light (space perpendicular direction in drawing) which penetrated the polarizing plate 209 among the light irradiated by the liquid crystal display panel 200 from the lighting system 100 passes the liquid crystal layer 207, and it carries out incidence to the reflective mold polarization selection member 300. Under the present circumstances, the polarization condition of the light which penetrates the liquid crystal layer 207 is modulated corresponding to image information, and the light 3100 which passes through a clear display field changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the reflective mold polarization selection member 300, and turns on an observer.

[0241] On the other hand, in order to carry out incidence of the light 3101 which passes a dark viewing area to the reflective mold polarization selection member 300 with the 2nd linearly polarized light light, it reflects by the reflective mold polarization selection member 300, and it does not result in an observer. The light 3101 reflected by the reflective mold polarization selection member 300 penetrates the liquid crystal layer 207 and a polarizing plate 209 again with the 2nd linearly polarized light light, and returns to a lighting system 100. Under the present circumstances, the polarization maintenance diffusion section which constitutes a lighting system 100, a transparent material, and the polarization maintenance reflective sheet 192 are penetrated or reflected, with the abbreviation maintenance of the polarization condition of the light which returns from the liquid crystal display component 200 side carried out. For this reason, incidence of the light 3101 which reflects with a lighting system 100 and faces to the liquid crystal display panel 200 is carried out to the liquid crystal layer 207, without absorbing almost with a polarizing plate 209, since it is the 2nd linearly polarized light light in general. Shortly, the light which carried out incidence to the clear display field among the light 3101 which carried out incidence to the liquid crystal layer 207 changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the reflective mold polarization selection member 300, and can use it effectively as an image light toward an observer.

[0242] That is, since it reflects by the reflective mold polarization selection member 300 at first, the light which carried out incidence to the dark viewing area does not turn into image light. However, toward a lighting system 100, where abbreviation maintenance of the polarization condition is carried out in a lighting system 100, it is reflected, and the light reflected by the reflective mold polarization selection member 300 faces to the liquid crystal display panel 200 again. For this reason, reuse of light will be performed in the condition that there is no big loss, and the brightness of a clear display field will improve.

[0243] Moreover, generally, although the light transmittance of a color filter is low, in order that it may not use a color filter by this example with about 25%, reuse of light will be performed more efficiently. [0244] Here, generally by the liquid crystal display panel, the brightness of a white display does not change by the case where the whole screen surface is white-displayed, and the case where a part is white-displayed. On the other hand, in CRT (Cathode Ray Tube), to the case where the whole screen surface is white-displayed, when white-displaying 15% of part of a screen, it is said that it is indicated bright by white about 4 times. this -- for example, sunlight etc. -- partial -- high -- when displaying a brightness image, in CRT, it becomes the difference of the image quality that an image more powerful than a liquid crystal display panel is obtained, and appears.

[0245] With the display of this example, by reusing the light which carried out incidence to the dark viewing area, since the brightness of a clear display field can be improved, when white-displaying a part, compared with the case where the whole screen surface is white-displayed, it can be indicated bright by white. Therefore, the powerful image near CRT will be obtained.

[0246] Furthermore, the following effectiveness is acquired when using this display as a display of pocket devices, such as a cellular phone. When turning on a lighting system, it functions as a electrochromatic display by the field sequential color display method, but when a lighting system is switched off, since there is no color filter, this display can be operated as a reflective mold liquid crystal display panel of a bright monochrome display. Here, in the case of a monochrome display, although it is necessary to display red and at least three green and blue subframes on performing the display of one frame in the case of color display, since it is not necessary to prepare a subframe, drive frequency can be made or less into 1/3. Since power consumption can be sharply reduced if

drive frequency can be lowered to 1/3 or less, if it prepares the drive frequency change section and enables it to change drive frequency in the state of a color display condition and a monochrome display, the power consumption of a monochrome display condition can be reduced sharply.
[0247] That is, power consumption can be made very low by turning on a lighting system, when a device is a busy condition, it being powerful by considering as a color display condition, and a bright high-definition image being obtained, and a device switching off a lighting system on the other hand at the time of standby, lowering drive frequency, and considering as a monochrome display condition, when this display is used as a display of a pocket device. For this reason, a cellular phone can await, for example and the time by the dc-battery of a pocket device -- time amount can be lengthened -- can be lengthened.
[0248] Furthermore, it is as above-mentioned that such effectiveness is realized in the top which can be changed, without deteriorating the mutual engine performance in an image display condition and a mirror condition. Moreover, in this example, it is good also as a configuration in which the function of a transparent electrode and a reflective mold polarization selection member is made to use also [ pattern / this / metal wire-like ] by forming a metal wire-like pattern in the transparence substrate by the side of the observer of a liquid crystal display panel, and making some each patterns into the electrically connected structure.
[0249] (Example 6) Other examples of this invention are hereafter explained based on a drawing.
[0250] The display with a change function to the mirror condition of the example 6 of this invention is explained using drawing 32 . This display attaches the same sign to the same member as the above-mentioned example in the example 1 mentioned above, using the reflective mold liquid crystal panel 3000 as the image display section 1000, and detailed explanation is omitted.
[0251] As for the display of this example 6, a reflective mold liquid crystal device has the liquid crystal layer 3130 closed to the space formed by carrying out the seal of the transparence substrate 3030, the reflective substrate 3100 equipped with the reflective section, and these two substrates by the sealant of the shape of lamination and a frame through spacers, such as a bead, including the reflective mold liquid crystal device 3000. Moreover, the phase contrast plate 3020, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 are arranged in piles at the transparence substrate 3030.
[0252] As a reflective substrate 3100, it was with flat insulating substrates, such as glass and a high polymer film, and the glass substrate with a thickness of 0.7mm was used here. It is formed on the switching element 3110 with which the reflective substrate 3100 was equipped at a scan electrode, signal electrodes, and these intersections and which consists of TFT (Thin FilmTransistor) etc., for example, the insulating layer 3090 formed in these upper parts, and an insulating layer, and has the pixel electrode 3070 subdivided in the shape of [ which was electrically connected with the switching element through the through hole 3120 which was able to be opened in the insulating layer 3090 ] a matrix.
[0253] The pixel electrode 3070 consists of a metal with high reflection factors, such as aluminum and silver, and functions as the reflective section of diffuse reflection nature with the detailed crevice or detailed heights configuration formed on the insulating layer 3090. The orientation film 3060 which consists of a polyimide system giant molecule is extensively formed in the upper layer of the pixel electrode 3070, and, as for the front face, surface treatment is made by the rubbing method etc.
[0254] The transparence insulating substrate flat as a transparence substrate 3030 in directions [ targets /, such as glass and a high polymer film, / optical ] could be used, and the glass substrate with a thickness of 0.7mm was used here. A color filter 3040 is formed in the location corresponding to the pixel electrode 3070 of the reflective substrate 3100 at the transparence substrate 3030. A color filter 3040 repeats by turns three kinds of color filters which have a transparency spectrum corresponding to red and the green and blue three primary colors, respectively, and arranges them in the location corresponding to the pixel electrode 3070.
[0255] Moreover, a black matrix is formed in the location which corresponds between the pixels of a color filter 3040, and you may make it stop the leakage light from between pixels. The transparent electrode 3050 which becomes the upper layer of a color filter 3040 from ITO through the overcoat layer which is not illustrated is formed extensively, the orientation film 3210 which becomes the

upper layer of a transparent electrode 3050 from a polyimide system giant molecule further is formed extensively, and surface treatment is performed for the front face by the rubbing method etc.

[0256] The transparence substrate 3030 and the reflective substrate 3100 are stuck so that transparent electrode 3050 forming face and reflector 3070 forming face may counter. Under the present circumstances, a bead spacer is distributed among both substrates and the space which has a fixed gap by carrying out the seal of the perimeter of the screen equivalent part of both substrates by the frame-like sealant is formed.

[0257] In the gap of both the substrates 3030 and 3100, the dielectric anisotropy enclosed and closed the liquid crystal constituent which carried out small quantity (0.1 - 0.2%) addition of the chiral agent to the forward nematic liquid crystal, and constituted the liquid crystal layer 3130. deltand of the liquid crystal layer 3130 could be 0.365 micrometers. By the surface treatment (orientation processing) performed on the orientation film 3210 with which the direction of the liquid crystal molecule major axis of the liquid crystal layer 3130 was formed on the transparence substrate 3030 and the reflective substrate 3100, and the orientation film 3060, the direction of orientation is specified and only a predetermined include angle will be in a distorted condition continuously between two substrates.

[0258] The laminating of the phase contrast plate 3020 is carried out to the transparence substrate 3030. As a phase contrast plate 3020, high polymer films which carried out uniaxial stretching, such as a polycarbonate, the poly ape phone, and polyvinyl alcohol, can be used. Here, deltand used the phase contrast plate which consists of a polycarbonate which is 0.18 micrometers as a phase contrast plate 3020.

[0259] The transparence substrate 3030, the phase contrast plate 3020, the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 were pasted up so that it might join together optically with acrylic adhesives, respectively.

[0260] Drawing 33 is drawing showing the shaft orientation of each part material of this display at the time of seeing from an observer side. The include angle of each shaft is shown at an angle of the circumference of a reverse clock from here on the basis of the location at horizontal direction 3:00 of an image display side. This display the liquid crystal orientation shaft by the side of the reflective substrate 3100 as shown in drawing 33 295 degrees, The lagging axis of 65 degrees and the phase contrast plate 3020 for the azimuth of the liquid crystal orientation shaft by the side of the transparence substrate 3030 135 degrees, The transparency polarization shaft of the linearly polarized light of 120 degrees and the absorption mold polarization selection member 500 was made [ the transparency polarization shaft of the linearly polarized light of the reflective mold polarization selection member 300 / the liquid crystal orientation shaft by the side of 30 degrees and the transparence substrate 402 ] into 120 degrees for the liquid crystal orientation shaft by the side of 30 degrees and the transparence substrate 401.

[0261] Next, actuation of this display is explained with reference to a drawing. in addition, the linearly polarized light component which penetrates the reflective mold polarization selection member 300 like the above-mentioned example 1 grade also in this example -- the 1st linearly polarized light component -- ** -- carry out and let the linearly polarized light component a component and this and a polarization shaft cross at right angles be the 2nd linearly polarized light component.

[0262] Drawing 34 shows the case where this display is in a mirror condition. In this case, although the outdoor daylight 3002 which faces to this display from an observer side is unpolarized light, in case it penetrates the absorption mold polarization selection member 500, the 1st linearly polarized light component is absorbed, only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. The outdoor daylight 3002 which carried out incidence to the transparency polarization shaft variant part 400 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, and results in the reflective mold polarization selection member 300. In order that the reflective mold polarization selection member 300 may penetrate the 1st linearly polarized light component and may carry out specular reflection of the 2nd linearly polarized light component, outdoor daylight 3002 reflects it by the reflective mold polarization selection member

300. The outdoor daylight 3002 reflected by the reflective mold polarization selection member 300 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, also penetrates the absorption mold polarization selection member 500 further, and turns on an observer.

[0263] That is, in the case of a mirror condition, outdoor daylight 3002 does not result in the reflective mold liquid crystal device 3000, it reflects by the reflective mold polarization selection member 300, and this display functions as a bright mirror toward an observer side.

[0264] In addition, when changing this display into a mirror condition, the reflective mold liquid crystal device 3000 is changed into a non-display condition, and it can avoid consuming useless power.

[0265] Drawing 35 and drawing 36 show the case where this display is in an image display condition. It explains also referring to drawing 32 about an image display condition. In this case, although it is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed and, as for the outdoor daylight 3002 which faces to a display from an observer side (left-hand side in drawing), only the 2nd linearly polarized light component penetrates it. In case the outdoor daylight 3002 which penetrated the absorption mold polarization selection member 500 penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the reflective mold polarization selection member 300, and it carries out incidence to the reflective mold liquid crystal device 3000. The 1st linearly polarized light light which carried out incidence to the reflective mold liquid crystal device 3000 passes the phase contrast plate 3020 and the liquid crystal layer 3130, and it reflects with the pixel electrode 3070, and it passes the liquid crystal layer 3130 and the phase contrast plate 3020 again, and they carry out incidence to the reflective mold polarization selection member 300. Under the present circumstances, the polarization condition of the light which penetrates the liquid crystal layer 3130 changes with the electrical potential differences impressed to the liquid crystal layer 3130.

[0266] Here, it connects with the pixel electrode 3070 through the through hole 3120, and a switching element 3110 can control the electrical potential difference impressed to the liquid crystal layer 3130 pinched by the transparent electrode 3050 and the pixel electrode 3070 for every pixel by switching the electrical potential difference impressed to the pixel electrode 3070. Therefore, the polarization condition of the light which passes the liquid crystal layer 3130 can be controlled by impressing the electrical potential difference corresponding to image information to a transparent electrode 3050 and the pixel electrode 3070, and impressing a predetermined electrical potential difference to the liquid crystal layer 3130, the quantity of light which penetrates the reflective mold polarization selection member 300 can be controlled by it, and an optical image can be formed by it.

[0267] Drawing 35 shows the case of clear display. With the configuration of this example, when the electrical potential difference is not impressed to the liquid crystal layer 3130, it reflects with the 1st linearly polarized light light, and the light which carried out incidence to the reflective mold liquid crystal device 3000 penetrates the reflective mold polarization selection member 300 again, and it carries out incidence to the transparency polarization shaft variant part 400. In case the light which carried out incidence to the transparency polarization shaft variant part 400 penetrates this, it changes from the 1st linearly polarized light light to the 2nd linearly polarized light light, penetrates the absorption mold polarization selection member 500, and serves as clear display toward an observation side.

[0268] Drawing 36 shows the case of a dark display. With the configuration of this example, if a predetermined electrical potential difference is impressed to the liquid crystal layer 3130, in case outgoing radiation of the 1st linearly polarized light light which carried out incidence to the reflective mold liquid crystal device 3000 is reflected and carried out by the reflective mold liquid crystal device 3000, it will turn into the 2nd linearly polarized light light, and will carry out incidence to the reflective mold polarization selection member 300 again. It reflects by the reflective mold polarization selection member 300, and incidence of the 2nd linearly polarized light light which carried out re-incidence to the reflective mold polarization selection member 300 is again carried out to the reflective mold liquid crystal device 3000. In case outgoing radiation of the 2nd linearly polarized light light which carried out incidence to the reflective mold liquid crystal device

3000 is reflected and carried out by the reflective mold liquid crystal device 3000, it turns into the 1st linearly polarized light light.

[0269] However, three kinds of color filters 3040 which have a transparency spectrum different, respectively corresponding to red and the green and blue three primary colors are repeatedly formed in the transparence substrate 3030 of the reflective mold liquid crystal device 3000 by turns in this case. therefore -- color filter 3040G [ for example, ] with a green light which carried out incidence to the reflective mold liquid crystal device 3000 first like illustration -- incidence -- it penetrates, and in the 2nd incidence, if incidence will be carried out to blue color filter 3040B, most light will be absorbed and will serve as a dark display. Moreover, in an outward trip return trip, though the light which carried out incidence to the reflective mold liquid crystal device 3000 passes the color filter of the same color, since a color filter will be passed a total of 4 times by 2 times, a dark display is obtained. That is, with the configuration of this example, the color filter is used as a member for raising the darkness of a dark display.

[0270] In order to realize a further sufficiently dark dark display, in case a color filter is passed 4 times, it is desirable to pass the color filter of a different color. For this reason, in order to make it the colors of the color filter which adjoins each other on four directions differ as much as possible, as for the array of a color filter, it is desirable to make it the delta array instead of the shape of a stripe.

[0271] Moreover, since the light reflected by the reflective mold polarization selection member 300 passes through the location where the reflective mold liquid crystal devices 3000 differ and becomes easy to pass the color filter of a different color the more the more the transparence substrate 3030 of the reflective mold liquid crystal device 3000 is thick, as for the transparence substrate 3030, it is desirable to make it as thick as possible within practical limits.

[0272] According to the display of this example 6 the above-mentioned passage, the reflective mold polarization selection member 300 is effectually switched to a transparent condition and the condition of functioning as a mirror by control of the polarization condition by the transparency polarization shaft variant part 400. Therefore, a bright image is obtained by making the reflective mold polarization selection member 300 into a transparent condition effectually in the state of image display. Even if it is a still brighter environment in a perimeter, degradation of image quality, such as a fall of reflected [ like / in the case of using a half mirror ] and the contrast ratio accompanying it and a brightness fall of image light, does not arise. That is, a switch of an image display condition and a mirror condition can be realized, without deteriorating the mutual engine performance.

[0273] By the way, this example described the case where the polarizing plate which functions on the reflective mold liquid crystal panel 3000 as an absorption mold polarization selection member was not prepared. This is because it is important for improving the brightness of an image display condition to reduce the member which absorbs light as much as possible. It is because an image is dark from the first, so it is in the situation which is not permitted that an image becomes dark further by the absorption mold polarization selection member, the transparency polarization shaft variant part, and the mirror function part that consists of a reflective mold polarization selection member by the reflective mold liquid crystal display panel in which especially color display is possible. It follows, for example, as long as it is an application, like the operating frequency in the location where outdoor daylight, such as the outdoors, is strong is high, you may make it prepare a polarizing plate in the reflective mold liquid crystal device 3000.

[0274] Furthermore, if the permeability to a predetermined linearly polarized light component is the polarizing plate of high permeability near 100%, even if it arranges the transparency polarization shaft of a polarizing plate together with the transparency polarization shaft of a reflective mold polarization selection member between the reflective mold liquid crystal device 3000 300, i.e., a reflective mold polarization selection member, and the transparence substrate 3030, since the brightness of an image is hardly reduced, it is desirable. In this case, generally, since the polarizing plate of high permeability has low degree of polarization, image display of contrast ratio sufficient in a reflective mold liquid crystal panel simple substance cannot be performed, but if a polarizing plate with degree of polarization high as an absorption mold polarization selection member 500 is used, a problem will not be produced for the display engine performance. Rather, there is an advantage that a darker dark display is realized in the case of image display, and image display of a high contrast ratio can be realized.

[0275] That is, if a polarizing plate with high degree of polarization is used for an absorption mold polarization selection member, degree of polarization is low to the absorption mold polarization selection member arranged to the reflective mold polarization selection member side of an image display member and a polarizing plate with high permeability is used when using the reflective mold liquid crystal display panel which contained the reflective section in the substrate as an image display member, a high contrast ratio is compatible with the brightness of an image.
[0276] In addition, although this example explained the case where the liquid crystal display panel of a reflective mold was used, you may make it make a reflective display and a transparency display serve a double purpose, as opening is prepared in some pixel electrodes which function as a reflective member and it penetrates partially. In this case, it is good for the rear-face side of a reflective member to arrange 1 / 4 phase-contrast plate, a polarizing plate, and a lighting system. According to such a configuration, the display of an image is attained by turning on a lighting system also under [, such as inside of Nighttime or a building, ] the weak situation of outdoor daylight.
[0277] (Example 7) Other examples of this invention are explained based on a drawing.
[0278] The display with a change function to the mirror condition of an example 7 is explained using drawing 37 . Moreover, drawing 38 is the mimetic diagram showing a general view of a cellular phone which used this display, drawing 38 (a) shows an image display condition, and drawing 38 (b) shows a mirror condition. Drawing 39 shows an example of the circuitry of the cellular phone using this display shown in drawing 38 .
[0279] The cellular phone 810 of this example 7 is constituted including the image display section 1000 and the mirror function part 801 of the carbon buttons 814, such as an antenna 811, a loudspeaker 812, and a ten key, a microphone 815, the circuit changing switch 813 of a mirror condition and an image display condition, and this display at least.
[0280] The cellular phone 810 of this example 7 is equipped with the communications department 10 which realizes a telephone function, the control unit 20 which inputs actuation, and the display 30 by this invention which can change an information-display condition and a mirror condition. The communications department 10 has the transmission / receive section 821 which connects with an antenna 811 and performs transmission/reception of signal transmission, the signal-processing section 822 which carries out signal transformation processing with this speech information and a transceiver signal while outputting and inputting speech information through a microphone 815 and a loudspeaker 812, and the communications control section 823 which controls transceiver actuation according to the operator guidance inputted. A control unit 20 is equipped with the ten key / carbon button 814 which performs various actuation inputs, and the circuit changing switch 813 for changing an information-display condition and a mirror condition.
[0281] The image display section 1000 which a display 30 is equipped with a lighting system 836, and performs an information display, The display and control section 831 which accepts control lead from the communications department 10 or a control unit 20, and performs motion control of a display, The drive circuit section 832 which drives the image display section 1000 according to the control signal from a display and control section 831, The mirror function part 801 which superposition arrangement is carried out at the image display section 1000, and realizes a mirror condition and a transparency condition alternatively, The applied-voltage generating section 834 which generates the applied voltage to the transparency polarization shaft variant part 400 of the mirror function part 801 at least, The mirror control section 833 which controls the applied-voltage generating section 834 to change the condition of the mirror function part 801 according to the directions from a circuit changing switch 813, or a communication link condition, It has the lighting switch 835 which performs lighting of a lighting system, and putting out lights according to the control signal from a display and control section 831 and the mirror control section 833.
[0282] Since area of the mirror function part 801 containing the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500 is made larger than the area of the image display field 1001 of the image display section 1000 and it has the same configuration as the above-mentioned example 1, and a function fundamentally except this, the same sign is attached to the same section as the above-mentioned example, and detailed explanation omits, as this display is shown in drawing 37 .
[0283] The reflective mold polarization selection member 300 of the mirror function part 801 is

being fixed to the substrate which constitutes the transparency polarization shaft variant part 400 by transparent adhesion material. Moreover, space 801S fixed are provided between the mirror function part 801 and the image display section 1000 by making into a spacer heights 801a formed in frame 810F of a cellular phone so that the reflective mold polarization selection member 300 may contact the image display section 1000 halfway and an interference fringe etc. may not occur.

[0284] Here, when it specifies that it is a main application that do not display the information on data etc. there in a mirror condition, but an observer projects his face, and this indicating equipment observes it as above-mentioned, a certain thing is desirable [ the magnitude of a mirror ] height of 58.6mm, and width of face of 39.1mm or more as above-mentioned. However, since an image display member has problems, like power consumption is improved when the image display section is enlarged, it is not made not much greatly. On the other hand, a problem is not produced because a mirror function part enlarges the area. Therefore, with the gestalt 7 of this operation, area of a mirror function part is made the configuration enlarged as much as possible irrespective of the area of the image display field 1001.

[0285] Moreover, the mirror function part 801 of this display can change a transparent condition and the condition of a mirror effectually by control of the polarization condition by the transparency polarization shaft variant part 400. Therefore, since it is not effectually affected at a substrate in the case of a transparence condition even if designs, such as a logo mark, were given upwards and the mirror function part 801 of a large area is arranged, the degree of freedom of the design of a device is not taken.

[0286] Next, actuation of the cellular phone 810 of this example is explained with reference to drawing 38 .

[0287] When performing image display even if it is a cellular phone at the busy condition or standby time as shown in drawing 38 (a), the mirror function part 801 is in the transparent condition effectually, and bright image display is obtained, and the logo mark and design of the image display section circumference are also visible. On the other hand, in the case of a mirror condition, a bigger mirror plane than the image display section will appear, and a practical mirror will be obtained as shown in drawing 38 (b).

[0288] In addition, since the indicating equipment of this example 7 constitutes the mirror condition and the image display condition so that a circuit changing switch 813 can perform by one-touch, its operability is high. A circuit changing switch 813 is constituted so that the case where about [ **3V-**5V ] alternating voltage is impressed to the electrode of the pair whose liquid crystal layer of the transparency polarization shaft variant part 400 is pinched, and the condition of short-circuiting the electrode of a pair may be changed. Power consumption is reduced, as a circuit changing switch 813 is furthermore interlocked with, the image display section 1000 is changed into the condition of not displaying in the case of a mirror condition and a lighting system is also switched off.

[0289] Moreover, since the change in the image display condition from a mirror condition can see arrival-of-the-mail information without switch actuation by constituting so that it may change automatically by arrival of the mail, a user's convenience improves further.

[0290] In addition, since the change of a mirror condition and an image display condition changes at dozens of m second and high speed when using TN liquid crystal device as a transparency polarization shaft variant part 400, inconvenience is not given to a user at all.

[0291] Moreover, although area of the mirror function part 801 was made larger than the area of the image display field 1001 in this example, in this invention, the ratio of the area of the field which can realize the mirror function part 801 or a mirror condition, and the area of the image display member of the image display field 1001, or a transparency mold / reflective mold is not limited to this example. Of course, it is also possible to consider as the configuration which puts a mirror function part on the image display section except for the field of specification [ **** / making area of a mirror function part smaller ] well also as almost the same [ in a double-sided product ] like each above-mentioned example. For example, it can consider as the configuration which does not cover only a part for the display of a mark by the mirror function part so that only the mark which shows whether a cellular phone is in the condition which can be communicated can always check.

[0292] Furthermore, although this example explained the case where the whole surface of a mirror function part was made into a mirror condition, the mirror field of a mirror function part can be

divided into plurality, and it can consider as the configuration which performs the change of a mirror condition and an image display condition for every division field, for example. It can carry out for every field which divided the electrical-potential-difference impression to a transparency polarization shaft variant part or an adjustable absorption mold polarization selection member, or can more specifically consider as the configuration on which a pixel electrode is arranged in the shape of a matrix, and the picture and alphabetic character of arbitration of a mirror condition are displayed.
[0293] (Example 8) Other examples of this invention are explained based on a drawing.
[0294] The example 8 of this invention is explained using drawing 40 , drawing 41 , and drawing 42 . In an example 8, the sign same about the same part as an example 7 is attached, and detailed explanation is omitted.
[0295] The configuration of this example 8 is the mirror function part of the attachment-and-detachment type which enables a user to give a mirror function to the existing cellular phone. The removable mirror function part 801 is constituted including the reflective mold polarization selection member 300, the transparency polarization shaft variant part 400, and the absorption mold polarization selection member 500, and adhesion immobilization of these is mutually carried out by transparent adhesion material as shown in drawing 41 . Moreover, transparent protection member 500P which consist of a film or a thin acrylic board are stuck on the front face of the absorption mold polarization selection member 500 by transparent adhesion material. The periphery section of the reflective mold polarization selection member 300 is equipped with the spacer 843 of the shape of a frame which has elasticity by the shape of sponge, and the front face of a spacer 843 is equipped with a double-sided tape 844 if needed. This spacer 843 is arranged, in order that the reflective mold polarization selection member 300 may not contact other members but may maintain fixed space, in case a mirror function part is attached in devices, such as a cellular phone. It has prevented that the reflective mold polarization selection member 300 and other members contact, and an interference fringe etc. occurs by this.
[0296] The transparency polarization shaft variant part 400 is connected with the mirror functional mechanical component 840 through wiring connected to the transparent electrode formed in the shape of [ which constitutes this ] a transparence substrate.
[0297] The mirror functional mechanical component 840 consists of drive circuits 847 which generate the electrical potential difference which drives the transparency polarization shaft variant part 400 by the electric power supply from the power source 845 which consists of a small cell, and a circuit changing switch 846 and a power source 845, drives the transparency polarization shaft variant part 400 by actuation of a circuit changing switch 846, and changes a mirror function part to a mirror condition and a transparent condition as shown in drawing 42 .
[0298] When attaching this mirror function part 801 in a cellular phone 810, wiring between the mirror function part 801 and the mirror functional mechanical component 840 can be considered as the configuration which attaches via the strap installation section 841 of a cellular phone, and is attached as if wiring 842 and the mirror functional mechanical component 840 were straps. In this case, even if it pulls the mirror functional mechanical component 840 accidentally, that force stops at the strap installation section 841 of a cellular phone, and there is an advantage that direct addition does not start in a mirror function part.
[0299] (Example 9) The display of the example 9 of this invention is explained based on drawing 43 .
[0300] The display of the example 9 of drawing 43 is made into the image display section which carries out outgoing radiation of the image light, using the organic electroluminescence (EL:electroluminescence) display panel 900, the same sign is attached to the same member as the above-mentioned example 1 grade, and detailed explanation is omitted.
[0301] This display consists of the organic electroluminescence display panel 900 which carries out outgoing radiation of the image light of the 1st linearly polarized light, a reflective mold polarization selection member 300, a transparency polarization shaft variant part 400, and an absorption mold polarization selection member 500. The organic electroluminescence display panel 900 penetrates the 1st linearly polarized light component to the side which meets the reflective mold polarization selection member 300, and the absorption mold polarization selection member 208 and the phase contrast plate 901 which absorb the 2nd linearly polarized light component the 2nd and this and a

polarization shaft cross at right angles are arranged.

[0302] Using a quarter-wave length plate as a phase contrast plate 901, ** is good, for example, can use high polymer films, such as a polycarbonate extended one shaft, the poly ape phone, and polyvinyl alcohol. In addition, although it is difficult to constitute the phase contrast plate which functions as a quarter-wave length plate to the whole region of visible wavelength with one kind of phase contrast plate with the wavelength dependency (following, wavelength dispersion) of the refractive index of the quality of the material which generally constitutes a quarter-wave length plate What was constituted so that it might function as a quarter-wave length plate in a large wavelength region by sticking at least two kinds of phase contrast plates with which wavelength dispersion differs so that the optical axis may be intersected perpendicularly can be used.

[0303] By pouring a current into the luminous layer which consists of an organic thin film, the organic electroluminescence display panel 900 is a spontaneous light type display device which transforms electrical energy into light energy and emits light, and has structure which carried out the laminating of the metal electrode 905 of the reflexibility which consists of the transparent electrode 903 which becomes the transparence substrate 902 from ITO, the hole transportation layer 904, a luminous layer 907, an electronic transportation layer 906, aluminum, etc. one by one. In order to control degradation, these cascade screens are sealed by the sealing compound 908 where oxygen and moisture are removed between the transparence substrate 902 and the closure member 909.

[0304] With the organic electroluminescence display panel, if direct current voltage is impressed between the transparent electrode 903 which is an anode plate, and the reflexibility metal electrode 905 which is cathode, each reaches [ the electron with which the hole poured in from the transparent electrode 903 was poured in from cathode (reflexibility metal electrode) 905 via the hole transportation layer 904 ] a luminous layer 907 via an electronic transportation layer, and it is thought that the recombination of an electronic-hole arises and luminescence of predetermined wavelength arises from here. Generally, in order to use efficiently the light which faced to the metal electrode 905 in order for there to be no directivity and to carry out outgoing radiation to an omnidirection isotropic as a display light, as for a metal electrode, it is [ the light which carries out outgoing radiation from a luminous layer 907 ] desirable to use an electrode material with a high reflection factor.

[0305] In addition, the configuration of the organic electroluminescence display panel 900 is not limited to the above-mentioned configuration. That is, the organic electroluminescence display panel concerning this invention can use the spontaneous light type display device which consists of a luminous layer and a reflexibility member arranged at the rear face of a luminous layer at least.

[0306] Next, actuation of the display of this example 9 is explained using drawing 43 . The right-hand side of drawing 43 shows an image display condition, and left-hand side shows a mirror condition.

[0307] When a display is in an image display condition, the transparency polarization shaft variant part 400 carries out to the condition, i.e., an OFF state, of not impressing an electrical potential difference to the liquid crystal layer 407 which constitutes this. After reflecting with the metal electrode 905 of direct or a rear face, outgoing radiation of the light which carried out outgoing radiation from the luminous layer in the case of the image display condition is carried out from the transparence substrate 902.

[0308] In case the image light 3201 which carried out outgoing radiation from the transparence substrate 902 penetrates the phase contrast plate 901 and the absorption mold polarization selection member 208 is passed, the 1st linearly polarized light component is penetrated and the 2nd linearly polarized light component the 2nd and this and a polarization shaft cross at right angles is absorbed. The image light 3201 which penetrated the absorption mold polarization selection member 208 also penetrates the reflective mold polarization selection member 300, and carries out incidence to the transparency polarization shaft variant part 400. In this case, the image light 3201 which passes the transparency polarization shaft variant part 400 changes from the 1st linearly polarized light to the 2nd linearly polarized light. Incidence of the image light 3201 which penetrated the transparency polarization shaft variant part 400 is carried out to the absorption mold polarization selection member 500. Since the absorption mold polarization selection member 500 absorbs the 1st linearly polarized light component and the 2nd linearly polarized light component penetrates, the image light

3201 which changed with transparency polarization shaft variant parts 400 to the 2nd linearly polarized light light penetrates the absorption mold polarization selection member 500, and is observed by the observer 2000.

[0309] On the other hand, although the outdoor daylight 3202 which carries out incidence from an observer 2000 side to a display is unpolarized light, in case the absorption mold polarization selection member 500 is penetrated, the 1st linearly polarized light component is absorbed and only the 2nd linearly polarized light component penetrates it. In case the outdoor daylight 3202 which penetrated the absorption mold polarization selection member 500 penetrates the transparency polarization shaft variant part 400, it changes from the 2nd linearly polarized light light to the 1st linearly polarized light light, penetrates the reflective mold polarization selection member 300, and it carries out incidence to the organic electroluminescence display panel 900.

[0310] In case the outdoor daylight 3202 which carried out incidence to the organic electroluminescence display panel 900 penetrates the absorption mold polarization selection member 208 and penetrates the phase contrast plate 901, it turns into the circular polarization of light (here for example, clockwise circular polarization of light) in response to the operation. A phase pi Shifts and the outdoor daylight 3202 which penetrated the phase contrast plate 901 turns into the circular polarization of light (counterclockwise circular polarization of light) with a reverse hand of cut, in case it reflects with a metal electrode 905. In case the outdoor daylight 3202 reflected with the metal electrode 905 penetrates the phase contrast plate 901 again, since it becomes the 2nd linearly polarized light shortly in response to the operation and is absorbed by the absorption mold polarization selection member 208, it does not return to an observer 2000 side.

[0311] Therefore, in the state of image display, since the image light 3201 which carried out outgoing radiation from the organic electroluminescence display panel 900 turns on an observer, without losing almost, it can obtain a bright image. Moreover, there is no reflection by the reflective mold polarization selection member 300 which functions as a mirror in the case of a mirror condition of 3202 outdoor daylight which carries out incidence to a display from a perimeter, and further, since the light reflected with the metal electrode 905 of the organic electroluminescence display panel 900 is absorbed by the absorption mold polarization selection member 208, it is hardly checked by looking by the observer 2000. That is, the high image display of a contrast ratio by which unnecessary reflection of outdoor daylight was controlled is realizable.

[0312] On the other hand, when making a display into a mirror condition, the transparency polarization shaft variant part 400 impresses electric field to the liquid crystal layer 407 which constitutes this, and is taken as an ON state. Although the outdoor daylight 3203 which faces to a display from an observer 2000 side in the case of a mirror condition is unpolarized light, in case it penetrates the absorption mold polarization selection member 500, the 1st linearly polarized light component is absorbed, only the 2nd linearly polarized light component penetrates it, and it carries out incidence to the transparency polarization shaft variant part 400. The outdoor daylight 3203 which carried out incidence to the transparency polarization shaft variant part 400 at this time penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light light, without a polarization shaft changing, and results in the reflective mold polarization selection member 300. By the reflective mold polarization selection member 300, in order to penetrate the 1st linearly polarized light component and to carry out specular reflection of the 2nd linearly polarized light component, outdoor daylight 3203 is reflected by the reflective mold polarization selection member 300. Since the outdoor daylight 3203 reflected by the reflective mold polarization selection member 300 penetrates the transparency polarization shaft variant part 400 with the 2nd linearly polarized light, without a polarization shaft changing, also penetrates the polarization selection member 500 further and turns on an observer, a mirror condition realizes it.

[0313] As for the viewing area of the organic electroluminescence display panel 900 applicable to the field which is in the mirror condition, at this time, it is desirable for actuation of a mirror function to be interlocked with and to consider as a nonluminescent condition. This actuation can realize the high-definition mirror which projects the reflected image of a high contrast ratio since the leakage of the light from the rear-face side of the reflective mold polarization selection member 300 can be abolished completely, and the power consumption of a display is reduced only for the part which controlled the amount of luminescence further.

[0314] However, even if it is the case where it is not necessary to necessarily change into a nonluminescent condition, and image light is carrying out outgoing radiation from the organic electroluminescence display panel 900 Since the image light which carries out outgoing radiation from the organic electroluminescence display panel 900 is the 1st linearly polarized light light which penetrated the absorption mold polarization selection member 208, Since the reflective mold polarization selection member 300 is penetrated, and the transparency polarization shaft variant part 400 is penetrated with the 1st linearly polarized light light, without a polarization shaft changing, it is absorbed by the absorption mold polarization selection member 500 and it is hardly observed by the observer 2000, The mirror which projects the reflected image of a high contrast ratio is realizable.
[0315] In addition, the property of the polarizing plate which functions as the absorption mold polarization selection member 208 or an absorption mold polarization selection member 500 is directly related to the ease of being visible of the image quality of an image display condition, or the mirror of a mirror condition. For this reason, it is effective like an example 1 to use a polarizing plate with high degree of polarization for one of the polarizing plates of the absorption mold polarization selection member 208 and the absorption mold polarization selection member 500, in order to improve brightness, and to use a polarizing plate with low degree of polarization for another side, maintaining sufficient contrast ratio in an image display condition.
[0316] Since the reflective mold polarization selection member which functions as a mirror is effectually switched to a transparent condition and the condition of functioning as a mirror by arbitration, like each example mentioned above according to the display of this invention, it is effective in the ability to realize a switch of an image display condition and a mirror condition, without deteriorating the mutual engine performance. That is, the bright image which image light hardly loses in the state of image display is obtained, and even if a perimeter is a bright environment, it is effective in a high-definition image without degradation of the image quality resulting from outdoor daylight called the fall of the contrast ratio accompanying reflected or it being obtained.
[0317] Since a bright mirror can be realized in the state of a mirror on the other hand since outdoor daylight is reflected efficiently, and the leakage of the light of image light is controlled further, it is effective in the mirror in which a contrast ratio projects a high reflected image being realizable. Therefore, the legible reflected image suitable for people projecting and observing their face and figure is acquired in a mirror condition.
[0318]
[Effect of the Invention] As mentioned above, according to this invention, the condition of displaying a high definition image, and the mirror condition that the legible reflected image suitable for people projecting and observing their face and figure is acquired can be provided with switchable equipment.

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[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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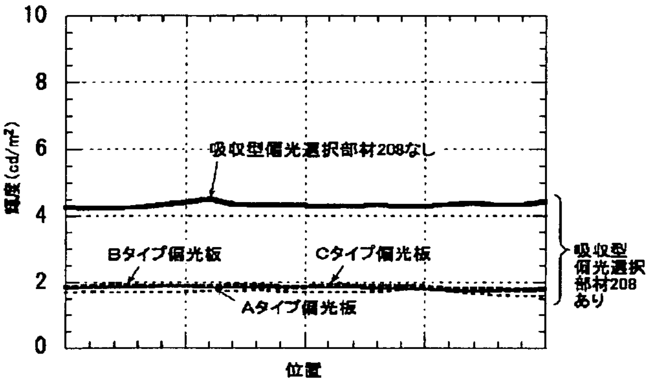
## DRAWINGS

[Drawing 3]

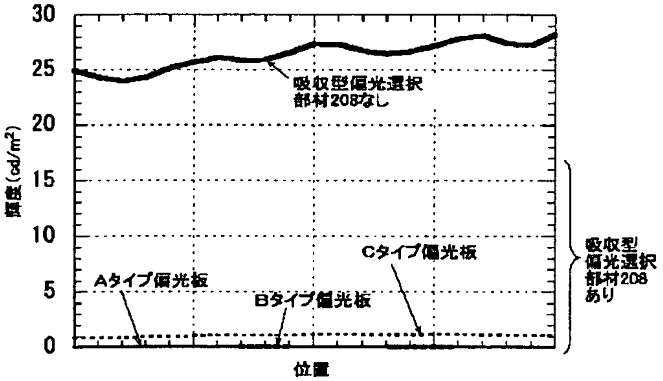
図 3



鏡状態での明表示領域の光漏れ

[Drawing 4]

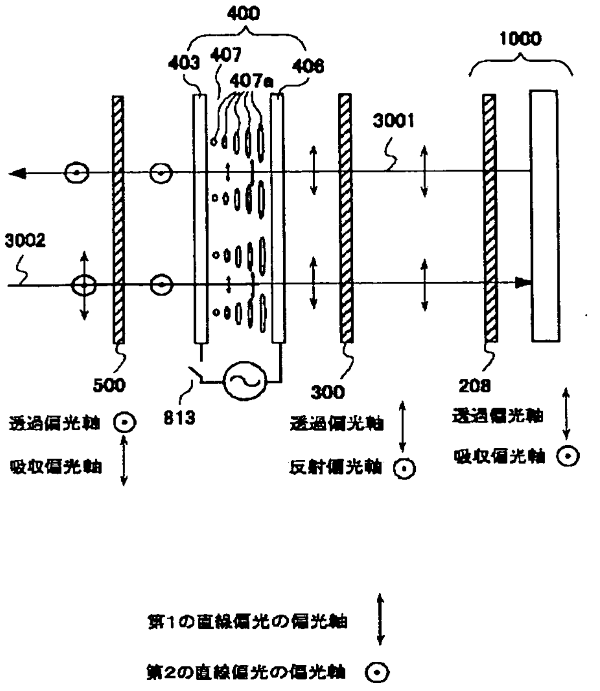
図 4



鏡状態での暗表示領域の光漏れ

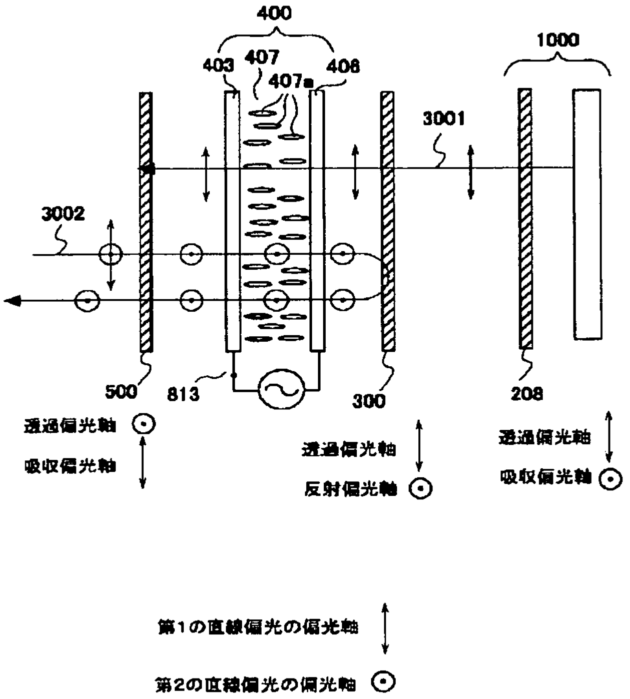
[Drawing 1]

図 1



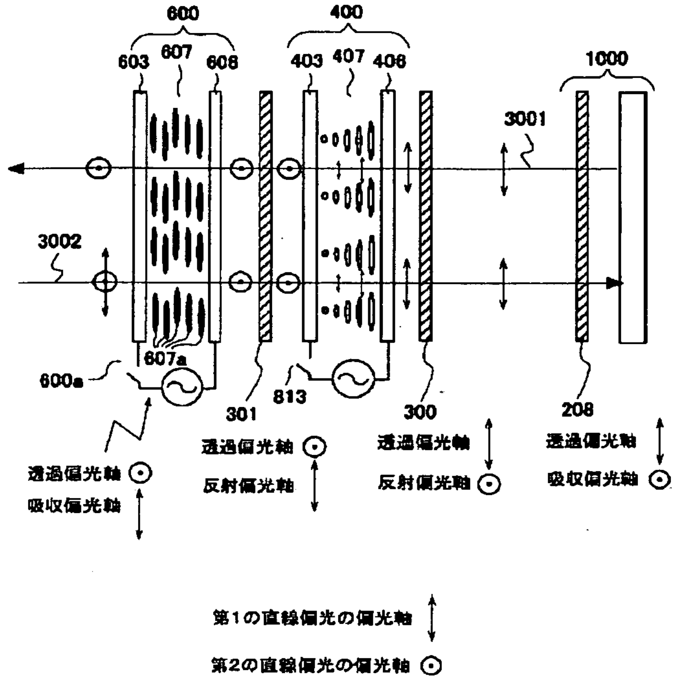
[Drawing 2]

図 2



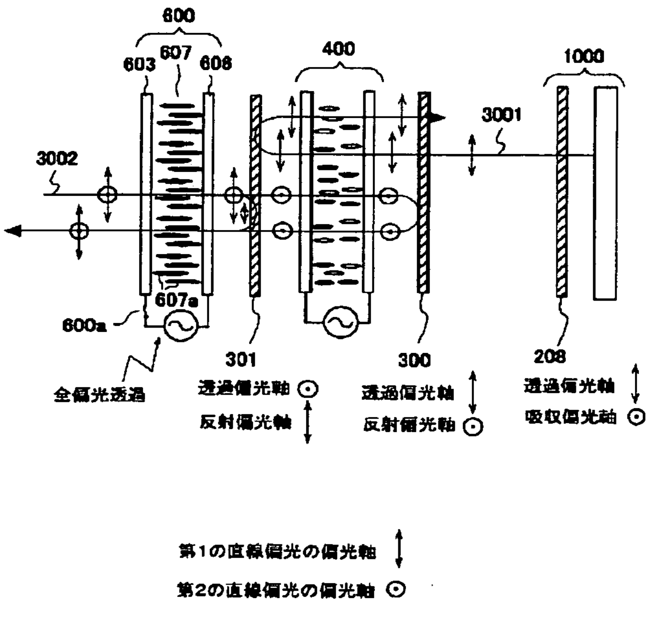
[Drawing 5]

図 5



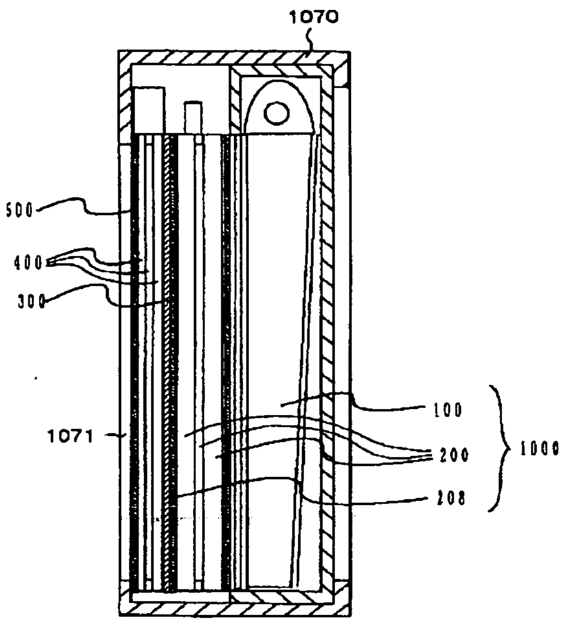
[Drawing 6]

図 6



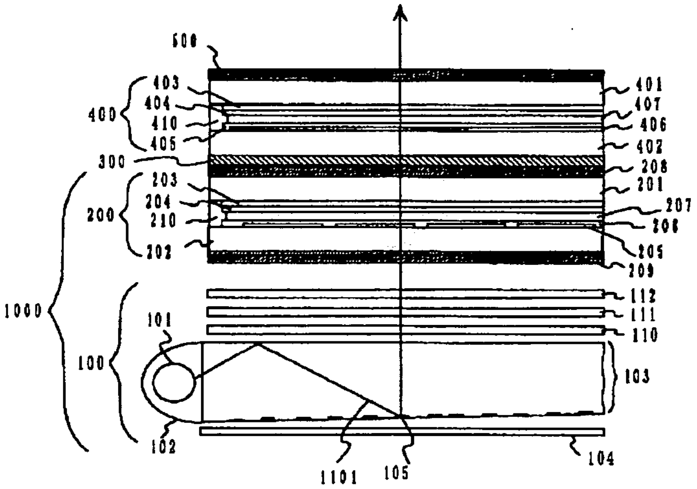
[Drawing 7]

図7



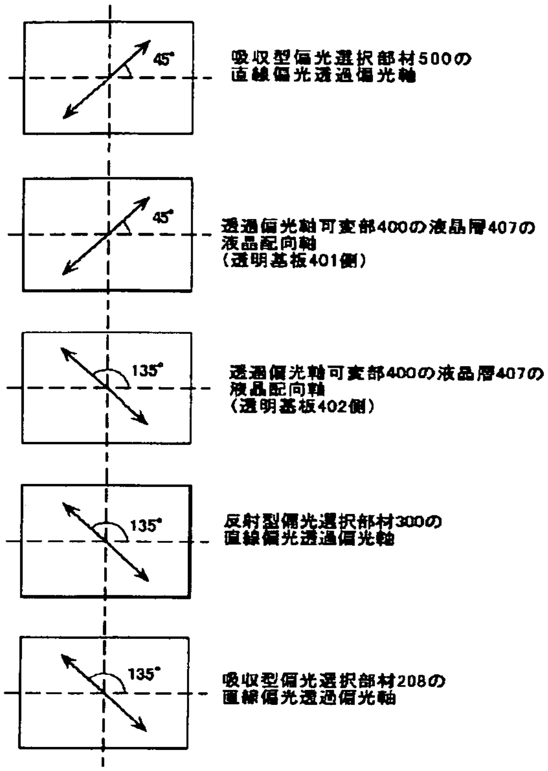
[Drawing 8]

図8



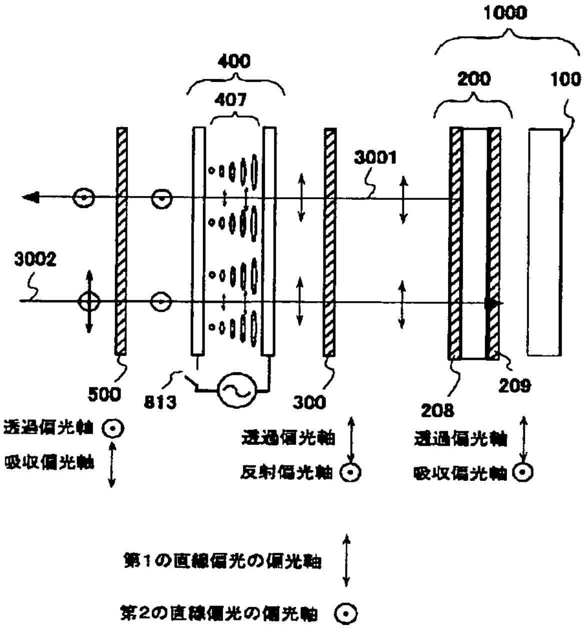
[Drawing 9]

図 9



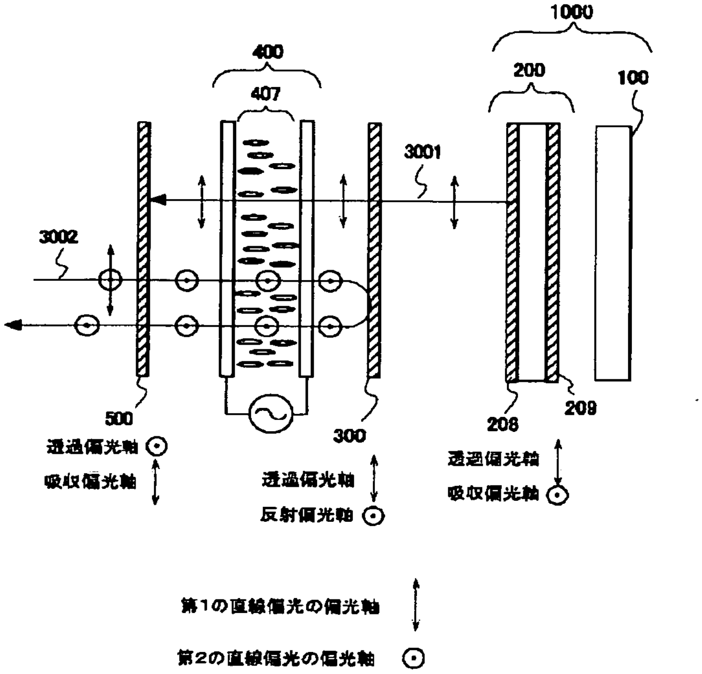
[Drawing 10]

図 10



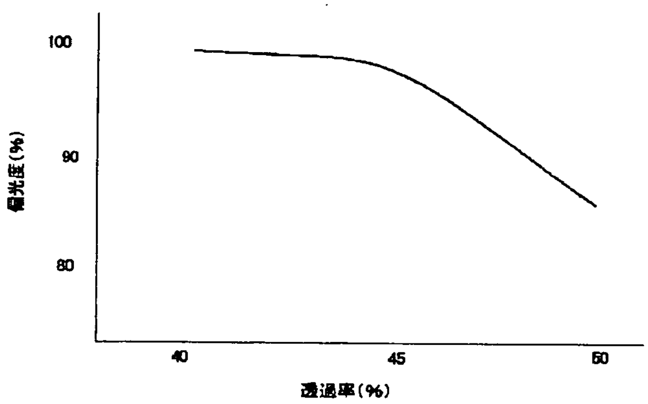
[Drawing 11]

図 11



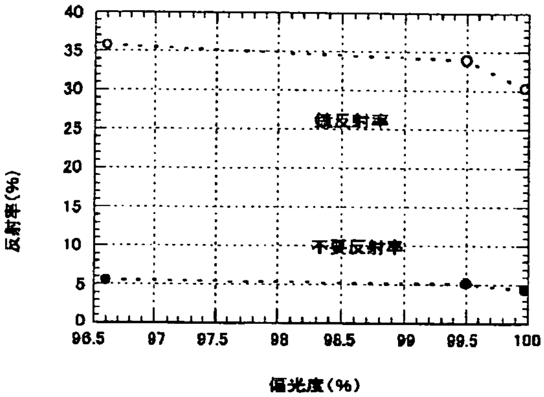
[Drawing 12]

図12



[Drawing 13]

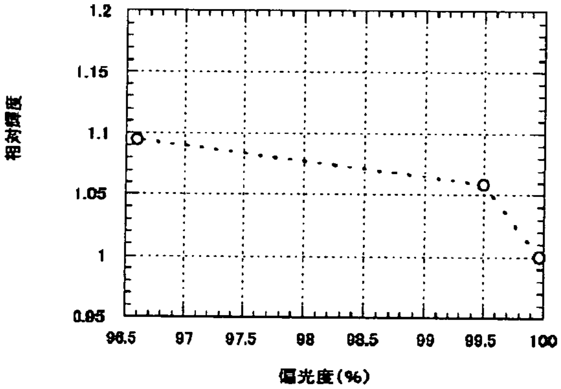
図13



吸収型偏光選択部材500の偏光度と鏡状態での反射率及び画像表示状態での不要反射率の関係

[Drawing 14]

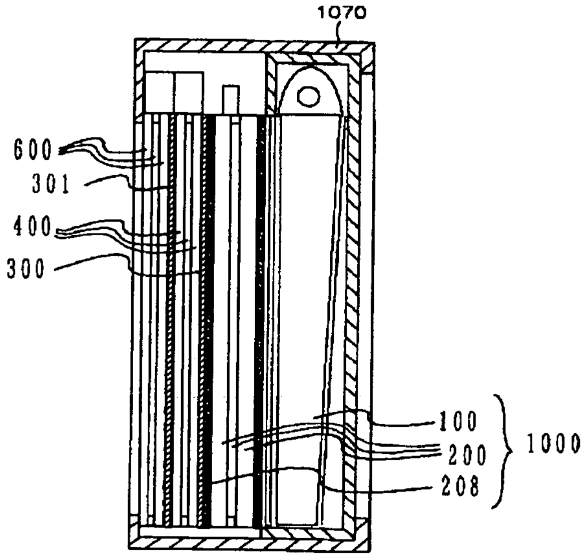
図14



吸収型偏光選択部材208の偏光度と表示輝度の関係

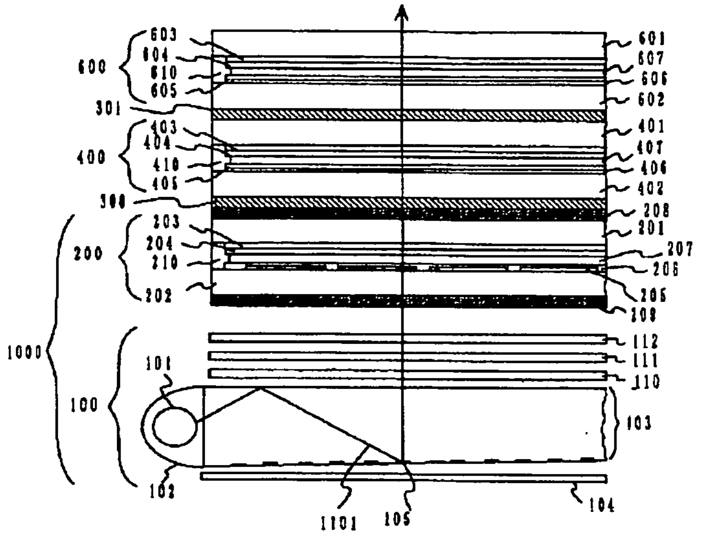
[Drawing 15]

図15



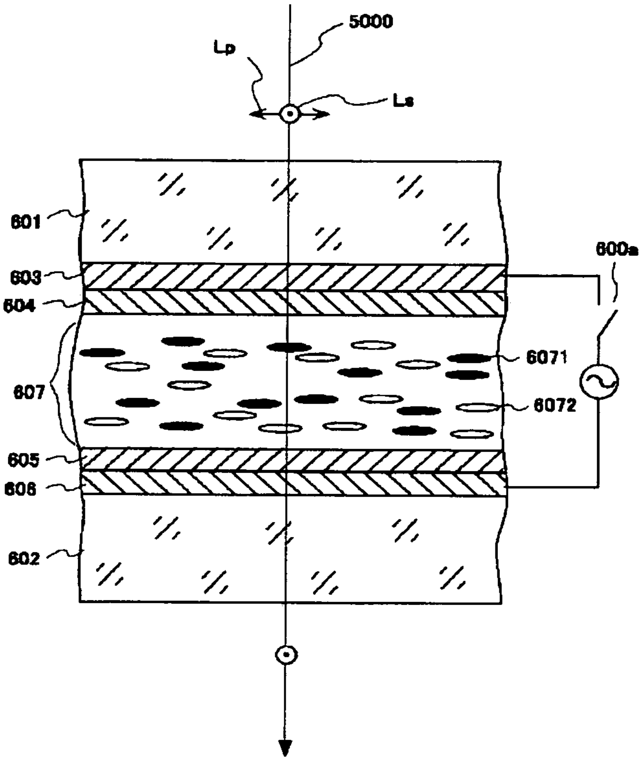
[Drawing 16]

図16



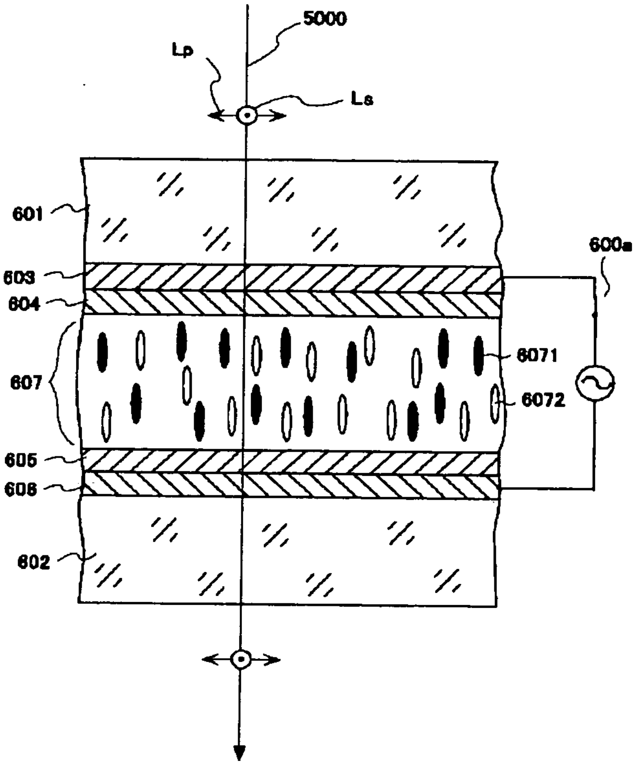
[Drawing 17]

図 17

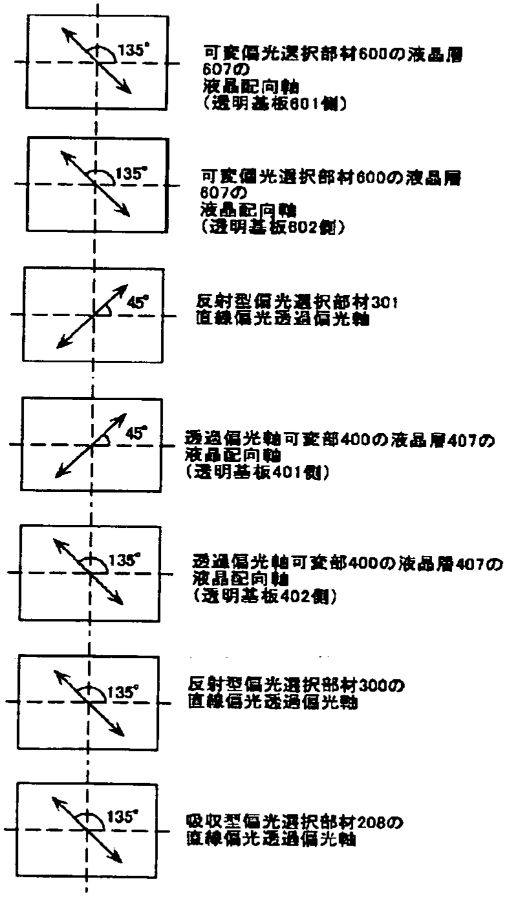


[Drawing 18]

図 18

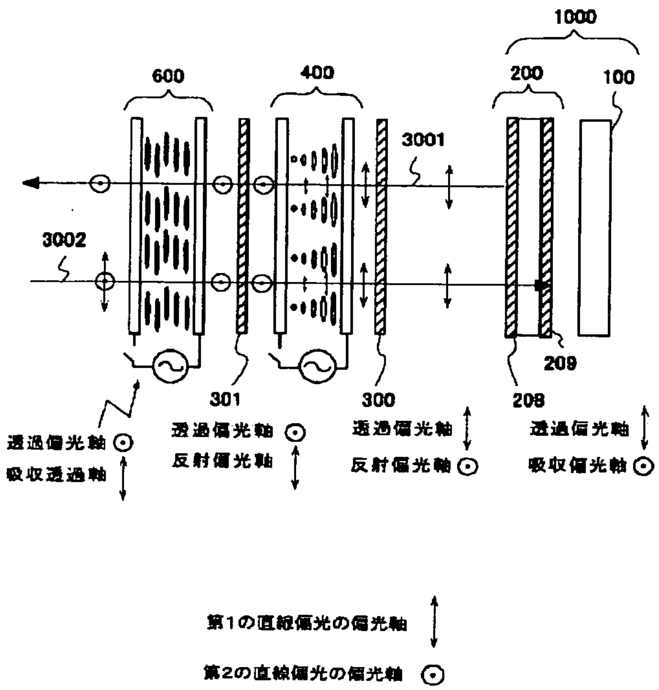


[Drawing 19]
図 19



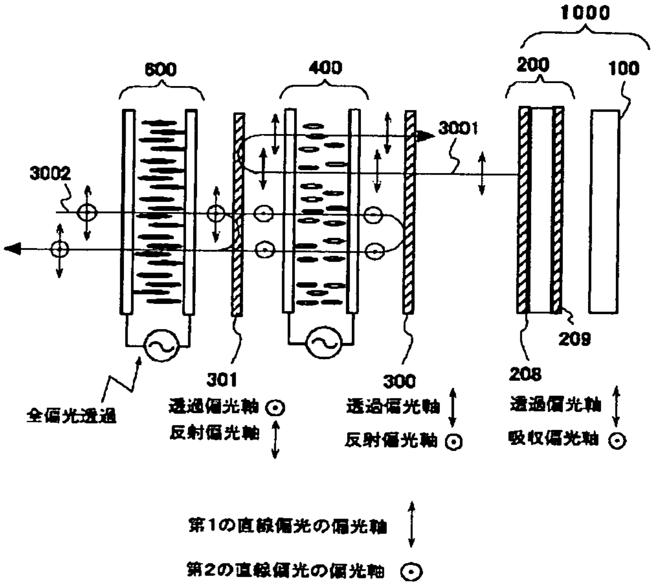
[Drawing 20]

図 20



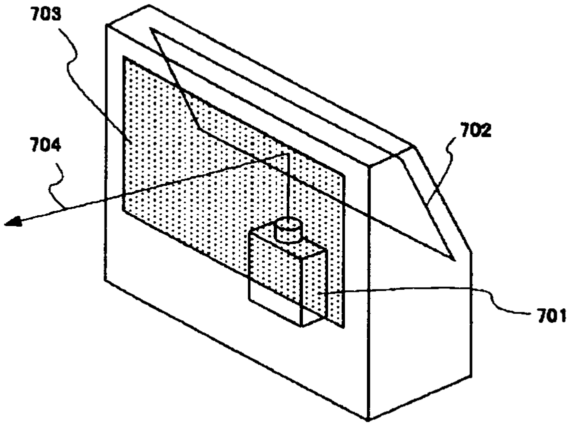
[Drawing 21]

図 21

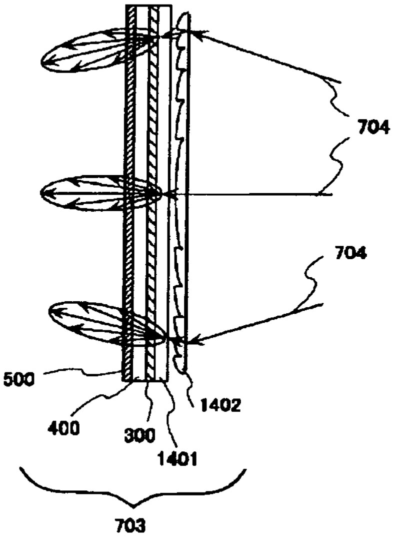


[Drawing 22]

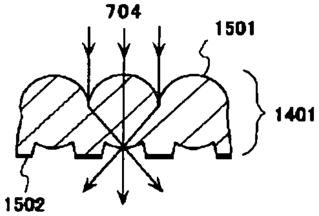
図 22



[Drawing 23]
図 23

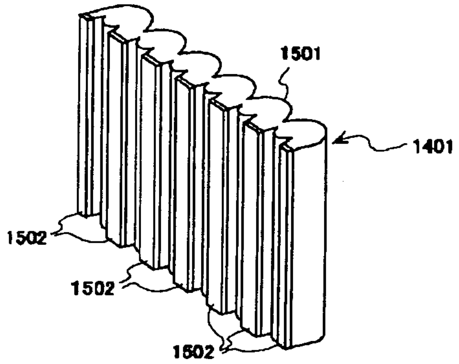


[Drawing 24]
図 24



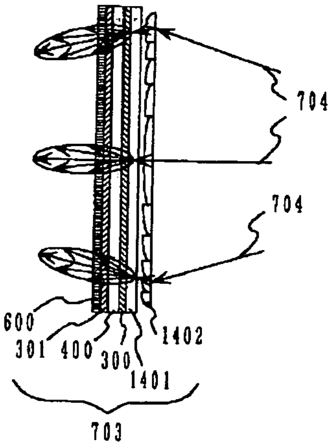
[Drawing 25]

図 25



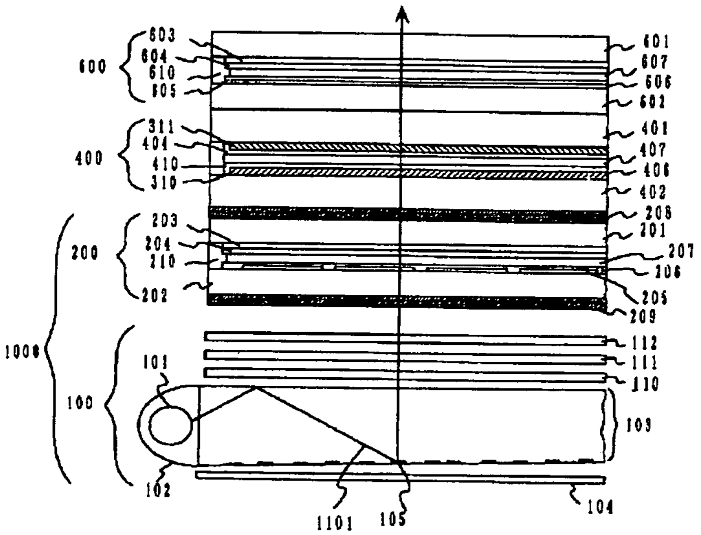
[Drawing 26]

図26



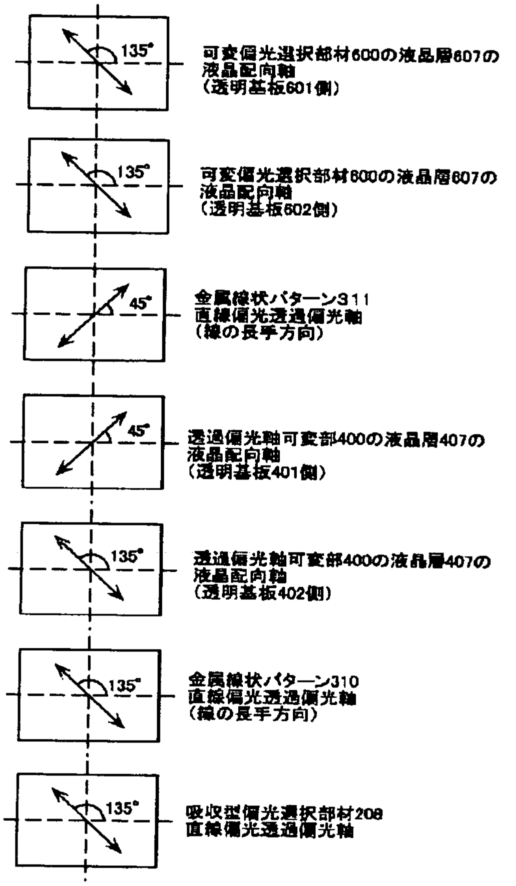
[Drawing 27]

図27



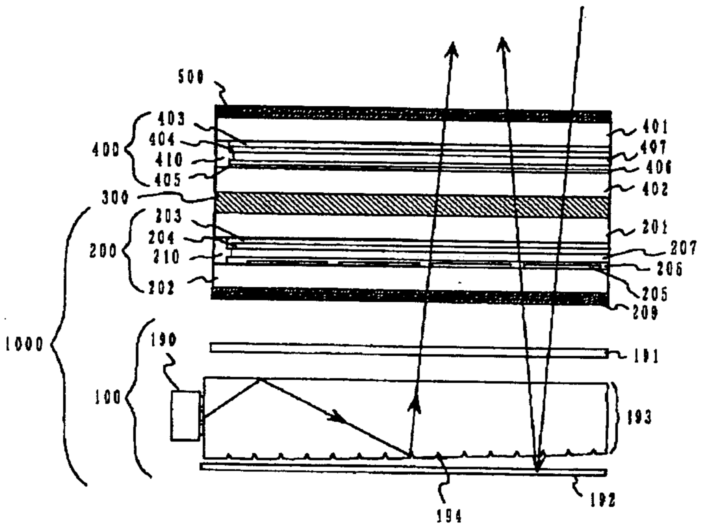
[Drawing 28]

**図 28**



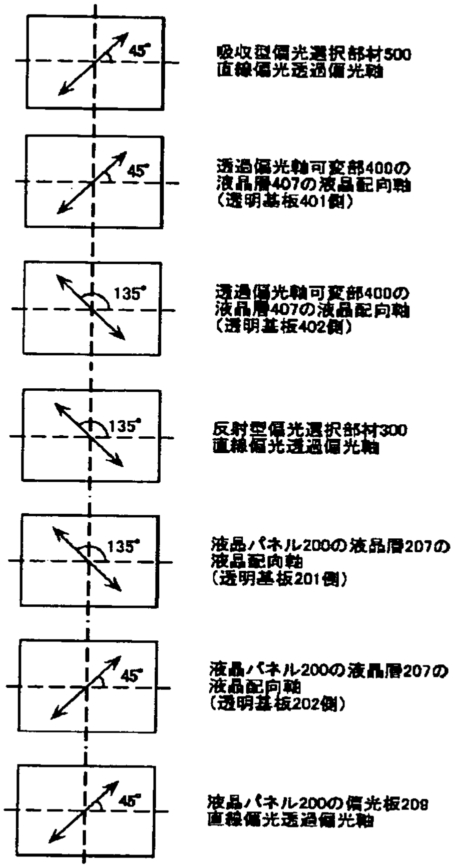
[Drawing 29]

**図29**



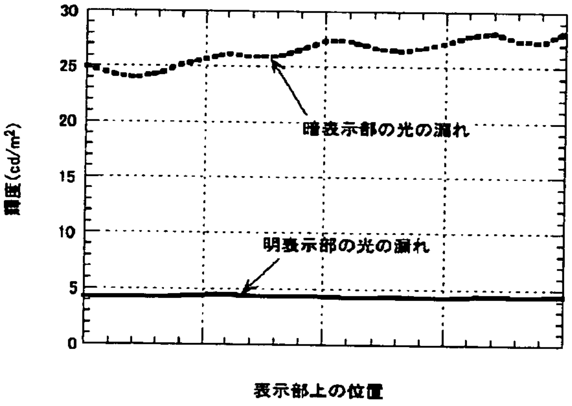
[Drawing 30]

図 30



[Drawing 44]

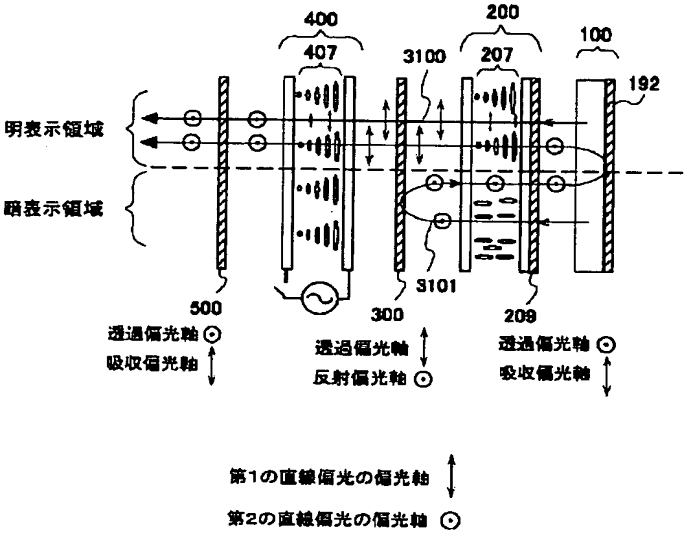
図 44



従来技術シャッタ状態（鏡状態）での光の漏れ（正面方向）

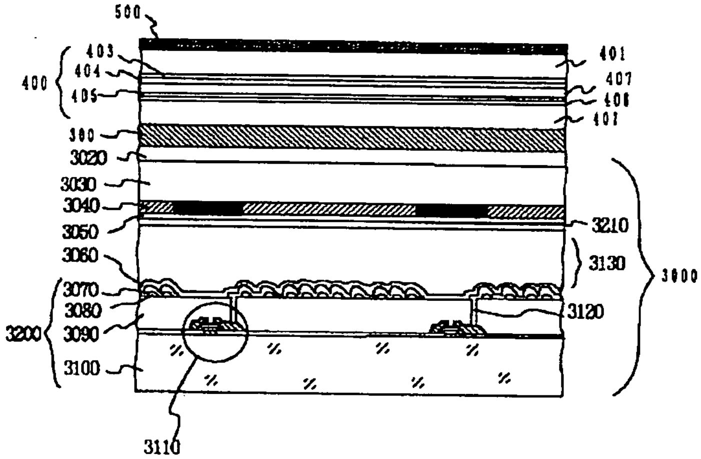
[Drawing 31]

図31



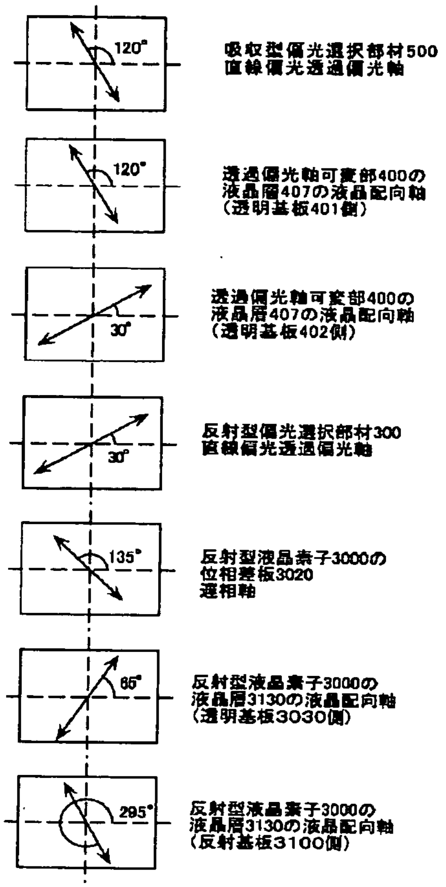
[Drawing 32]

図32



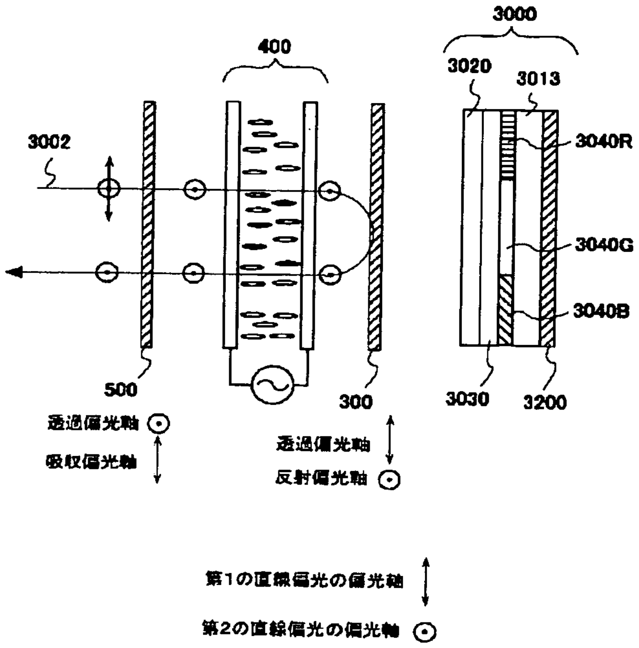
[Drawing 33]

図 33



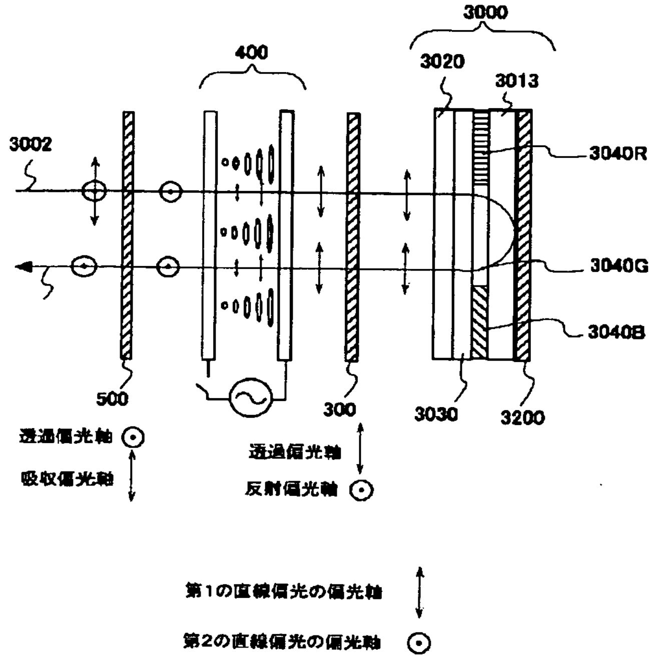
[Drawing 34]

図 34



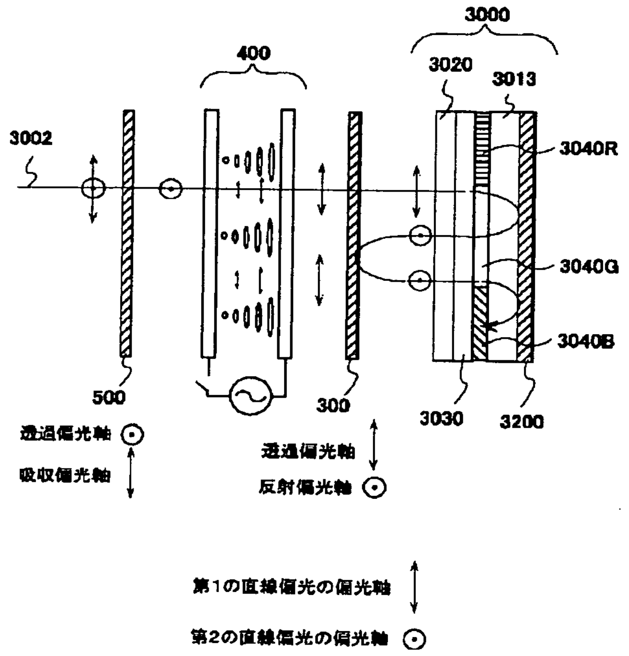
[Drawing 35]

図 35



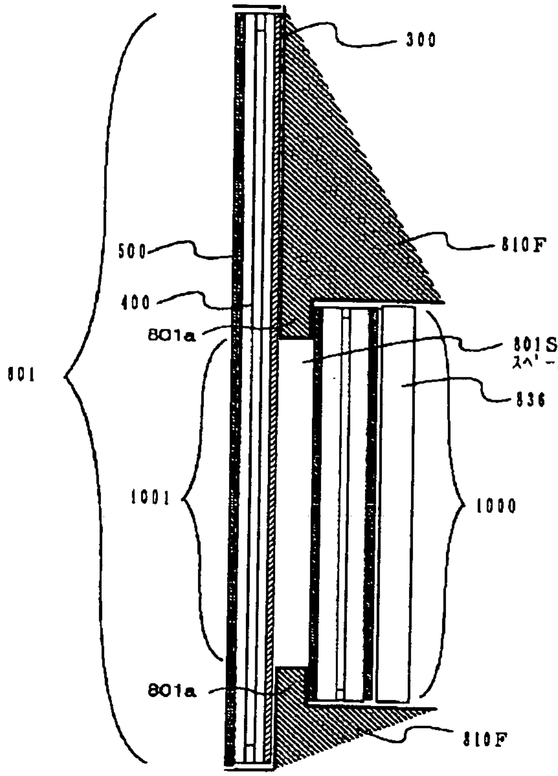
[Drawing 36]

図 36



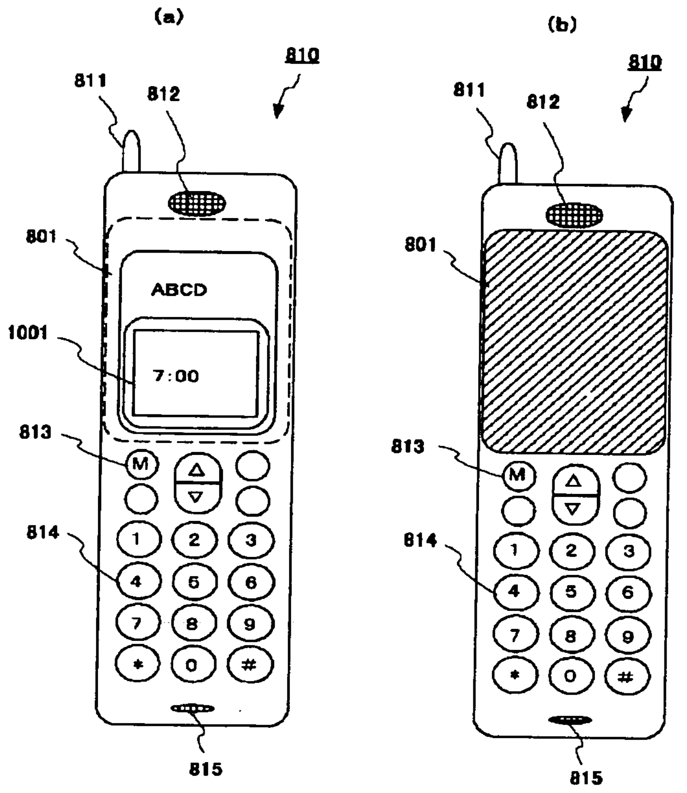
[Drawing 37]

図37



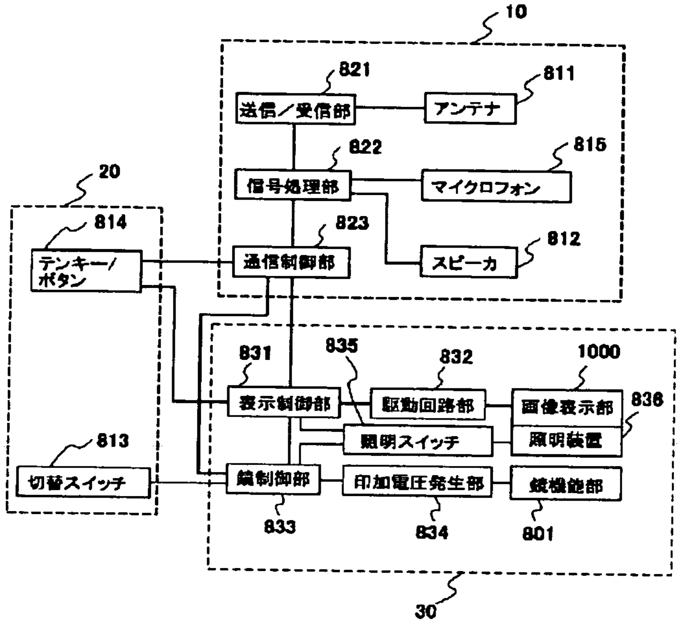
[Drawing 38]

図 38



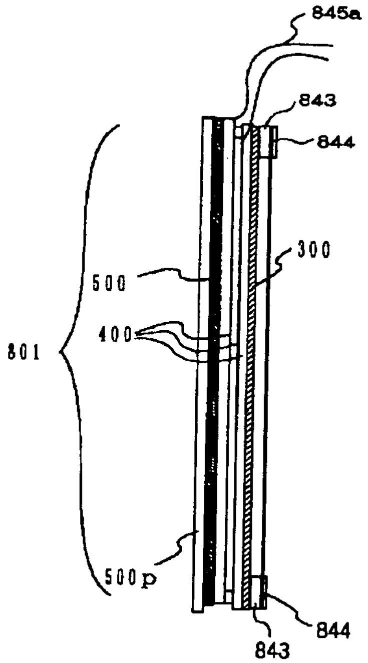
[Drawing 39]

図 39



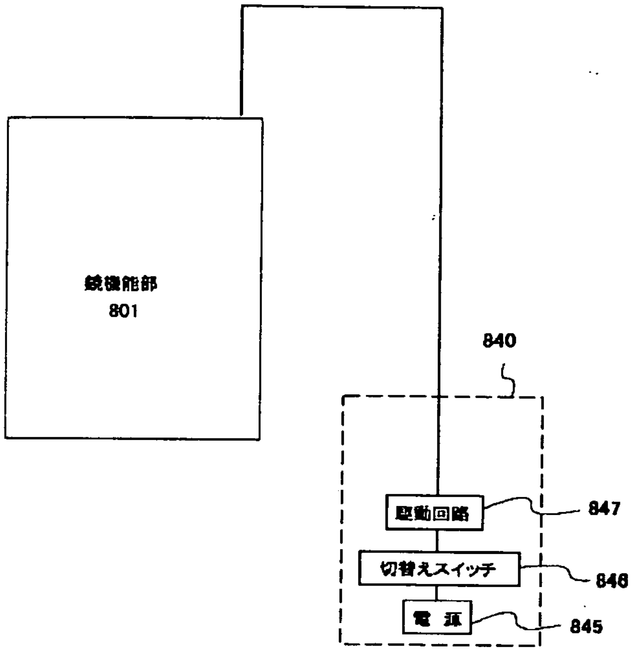
[Drawing 41]

図41



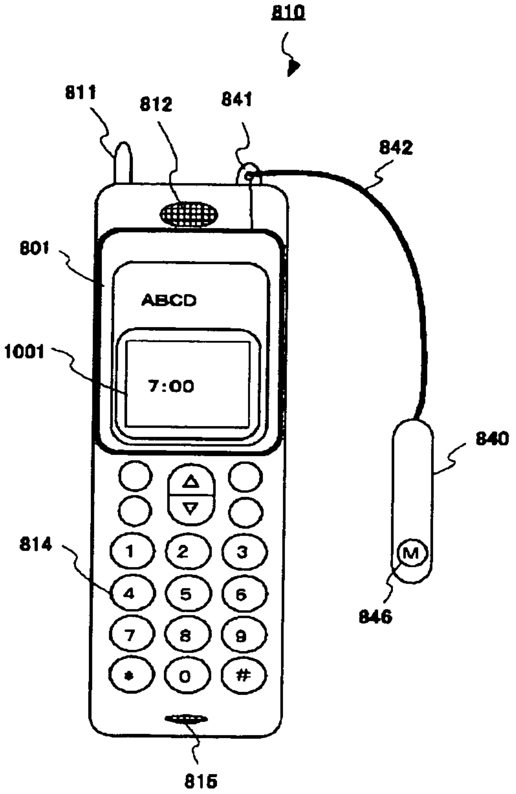
[Drawing 42]

図 42



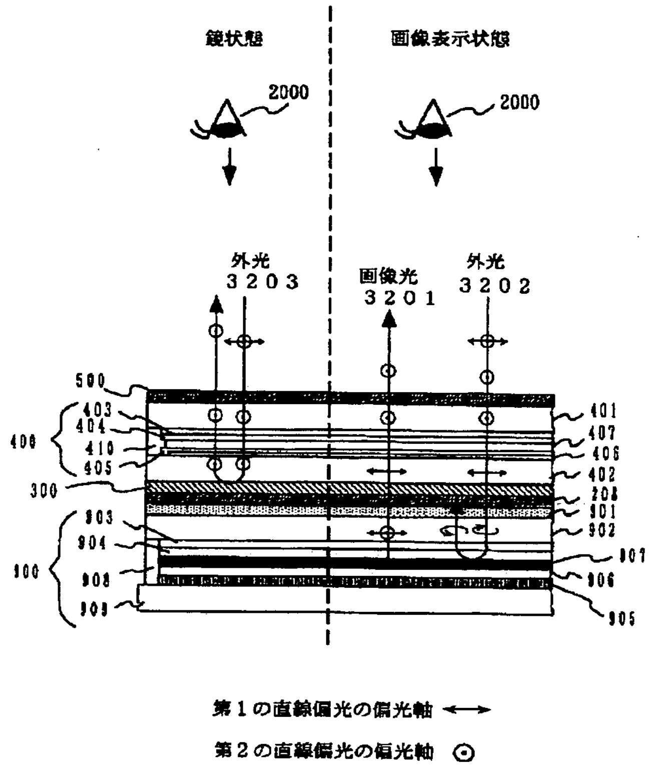
[Drawing 40]

図 40



[Drawing 43]

図43



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## CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] January 15, Heisei 15 (2003. 1.15)

[Publication No.] JP,2001-318374,A (P2001-318374A)
[Date of Publication] November 16, Heisei 13 (2001. 11.16)
[Annual volume number] Open patent official report 13-3184
[Application number] Application for patent 2001-56034 (P2001-56034)
[The 7th edition of International Patent Classification]

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G02F   1/1335  510
520
1/13357
G09F   9/00    313
324
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[FI]

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G02F   1/1335  510
520
G09F   9/00    313
324
G02F   1/1335  530
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[Procedure revision]
[Filing Date] October 7, Heisei 14 (2002. 10.7)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]

[Claim 1] It has a switchable mirror function part in the image display section which carries out outgoing radiation of the image light for displaying a desired image, the image transparency condition which has been arranged by superimposing on said image display section and which penetrates said image light, and the mirror condition of reflecting outdoor daylight,
This mirror function part includes the reflective mold polarization selection means arranged sequentially from said image display section side, a transparency polarization shaft adjustable means, and an absorption mold polarization selection means. Said reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means It is switchable in the condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, and the

condition of penetrating without changing the polarization shaft of the light which carried out incidence, and said absorption mold polarization selection means penetrates one side among said 1st polarization and said 2nd polarization, and absorbs another side,
Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.
[Claim 2] In equipment according to claim 1, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means By changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said mirror function part to said image transparency condition, and changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence.
[Claim 3] In equipment according to claim 1, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means By changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said mirror function part to said image transparency condition, and changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization.
[Claim 4] It has a switchable mirror function part in the image display section which carries out outgoing radiation of the image light for displaying a desired image, the image transparency condition which has been arranged by superimposing on said image display section and which penetrates said image light, and the mirror condition of reflecting outdoor daylight,
1st reflective mold polarization selection means by which this mirror function part has been arranged sequentially from said image display section side, A transparency polarization shaft adjustable means, the 2nd reflective mold polarization selection means, and an adjustable polarization selection means are included. Said 1st reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means The condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, Are switchable in the condition of penetrating without changing the polarization shaft of the light which carried out incidence. Said 2nd reflective mold polarization selection means It is switchable in the condition of reflecting one side among said 1st polarization and said 2nd polarization, penetrating another side, and said adjustable polarization selection means absorbing one side among said 1st polarization and the 2nd polarization, and penetrating another side, and the condition of penetrating all polarization components,
Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.
[Claim 5] In equipment according to claim 4, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means While changing said 1st polarization to the condition of making it changing to said 2nd polarization, said transparency polarization shaft adjustable means By changing to the condition of absorbing said 1st polarization for said adjustable polarization selection means, and penetrating said 2nd polarization While changing said mirror function part to said image transparency condition and changing to the condition of penetrating said transparency polarization shaft adjustable means without changing said polarization shaft which carried out incidence It is switchable equipment about the image display condition and mirror condition which are characterized by changing said

mirror function part to said mirror condition by changing said adjustable polarization selection means to the condition of penetrating said all polarization components.

[Claim 6] In equipment according to claim 4, it has a change means for changing said mirror function part to said image transparency condition in the state of said mirror. This change means While changing said transparency polarization shaft adjustable means to the condition of penetrating without changing said polarization shaft which carried out incidence By changing to the condition of absorbing said 2nd polarization for said adjustable polarization selection means, and penetrating said 1st polarization While changing said mirror function part to said image transparency condition and changing said transparency polarization shaft adjustable means to the condition of changing said 1st polarization to said 2nd polarization It is switchable equipment about the image display condition and mirror condition which are characterized by changing said mirror function part to said mirror condition by changing said adjustable polarization selection means to the condition of penetrating said all polarization components.

[Claim 7] It has a switchable mirror function part in the image display section which carries out outgoing radiation of the image light for displaying a desired image, the image transparency condition which has been arranged by superimposing on said image display section and which penetrates said image light, and the mirror condition of reflecting outdoor daylight,

1st reflective mold polarization selection means by which this mirror function part has been arranged sequentially from said image display section side, A transparency polarization shaft adjustable means and the 2nd reflective mold polarization selection means are included. Said 1st reflective mold polarization selection means Polarization of the 1st of the polarization shaft defined beforehand is penetrated, and said 1st polarization and the 2nd polarization which a polarization shaft intersects are reflected. Said transparency polarization shaft adjustable means It is switchable in the condition of changing said 1st polarization which carried out incidence to said 2nd polarization, and penetrating it, and the condition of penetrating without changing the polarization shaft of the light which carried out incidence, said 2nd reflective mold polarization selection means reflects one side among said 1st polarization and said 2nd polarization, and another side is penetrated,

Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by carrying out outgoing radiation, using as said image light said 1st polarization which penetrated said 1st polarization, was equipped with a polarization selection means for image light to absorb said 2nd polarization, and penetrated said polarization selection means for image light.

[Claim 8] It is switchable equipment about the image display condition and mirror condition which are characterized by changing said image display section to the condition of making it this interlocked with and not carrying out outgoing radiation of said image light when said image display section is switchable in the condition of not carrying out outgoing radiation of said image light, in equipment given in claims 2, 3, 5, or 6 and said change means changes said mirror function part to said mirror condition.

[Claim 9] Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by switching off said lighting system or changing said liquid crystal device to a dark display in order to change said image display section to the condition that said change means does not carry out outgoing radiation of said image light in equipment according to claim 8 including a lighting system and a liquid crystal device.

[Claim 10] In equipment according to claim 8, said transparency polarization shaft adjustable means is a configuration switchable in the condition of penetrating only some fields without changing said polarization shaft which carried out incidence,

Said change means is switchable equipment about the image display condition and mirror condition which are characterized by changing the display of said image display section of the part which overlaps said some of fields to a dark display, and not carrying out outgoing radiation of said image light from the part concerned when only said some of fields are changed to the condition of penetrating without changing said polarization shaft which carried out incidence.

[Claim 11] It is. equipment according to claim 1, 4, or 7 -- said transparency polarization shaft adjustable means A liquid crystal layer and the electrode for impressing electric field in the direction of thickness of this liquid crystal layer are included. This liquid crystal layer When it is the configuration that the direction of a major axis of a liquid crystal molecule becomes parallel to the direction of thickness when the direction of a major axis of a liquid crystal molecule is continuously twisted 90 degrees in the direction of thickness when electric field are not impressed, and electric field are impressed, and said mirror function part is in a mirror condition, Said transparency polarization shaft adjustable means is switchable equipment about the image display condition and mirror condition which are characterized by being in the condition of impressing electric field to said liquid crystal layer.

[Claim 12] It is. equipment according to claim 1, 4, or 7 -- said transparency polarization shaft adjustable means A liquid crystal layer and the electrode for impressing electric field in the direction of thickness of this liquid crystal layer are included. This liquid crystal layer When it is the configuration that the direction of a major axis of a liquid crystal molecule becomes parallel to the direction of thickness when the direction of a major axis of a liquid crystal molecule is continuously twisted 90 degrees in the direction of thickness when electric field are not impressed, and electric field are impressed, and said mirror function part is in a mirror condition, Said transparency polarization shaft adjustable means is switchable equipment about the image display condition and mirror condition which are characterized by being in the condition of not impressing electric field to said liquid crystal layer.

[Claim 13] It is switchable equipment about the image display condition and mirror condition which are characterized by filling the relation of 0.966 <=P1 <=0.995 <=P2 in equipment according to claim 1 when the degree of polarization of P1 and said absorption mold polarization selection means is set to P2 for the degree of polarization of said polarization selection means for image light.

[Claim 14] When the degree of polarization of P1 and said absorption mold polarization selection means is set to P2 for the degree of polarization of said polarization selection means for image light in equipment according to claim 1, It is switchable equipment about the image display condition and mirror condition which are characterized by changing said image display section to the condition of making it this interlocked with and not carrying out outgoing radiation of said image light when the relation of 0.966 <=P2 <=0.995 <=P1 is filled and said mirror function part is changed to said mirror condition.

[Claim 15] Said 1st reflective mold polarization selection means is switchable equipment about the image display condition and mirror condition which are characterized by being arranged so that spacing with said 2nd reflective mold polarization selection means may be set to 0.11mm or less in equipment according to claim 4 or 7.

[Claim 16] It is switchable equipment about the image display condition and mirror condition which are characterized by the area size from which said mirror function part will be in a mirror condition in equipment according to claim 1, 4, or 7 being 58.6mmx39.1mm at least.

[Claim 17] Said image display section is switchable equipment about the image display condition and mirror condition which are characterized by arranging the phase contrast plate and said polarization selection means for image light in equipment according to claim 1 including an organic electroluminescence display device between the luminous layer of an organic electroluminescence display device, and said reflective mold polarization selection means.

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[Translation done.]

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